(19) 대한민국특허청(KR)
(12) 공개특허공보(A)

(11) 공개번호 10-2014-0079993
(43) 공개일자 2014년06월30일

(51) 국제특허분류(Int. Cl.)
C09K 11/06 (2006.01) *H01L 51/50* (2006.01)
(21) 출원번호 10-2012-0149289
(22) 출원일자 2012년12월20일
심사청구일자 없음

(71) 출원인
엘지디스플레이 주식회사
서울특별시 영등포구 여의대로 128(여의도동)
(72) 발명자
허혜령
경기 파주시 월롱면 엘씨디로 201, 정다운마을 C동 825호
신인애
부산 부산진구 엄광로282번길 10-1, (가야동)
(74) 대리인
특허법인로얄

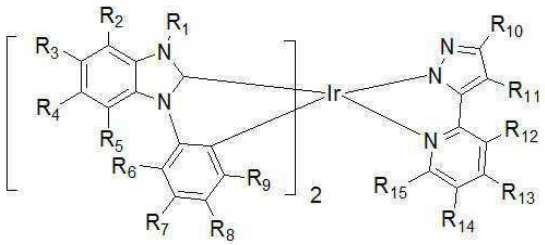
전체 청구항 수 : 총 7 항

(54) 발명의 명칭 **청색 인광 화합물 및 이를 사용한 유기전계발광소자**

(57) 요 약

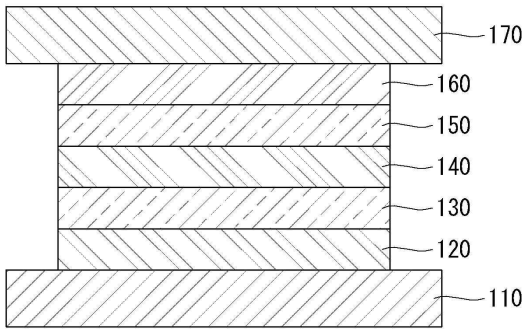
본 발명의 일 실시예에 따른 청색 인광 화합물은 하기 화학식 1로 표시되는 것을 특징으로 한다.

[화학식 1]



상기 화학식 1에서, R_1 내지 R_{15}는 각각 독립적으로 수소, 중수소. F, Cl, Br의 할로겐, C1 내지 C20의 알킬기, C1 내지 C20의 알콕시기, C1 내지 C20의 사이클로 알킬기, C6 내지 C20의 치환 또는 비치환된 방향족 그룹, C5 내지 C20의 치환 또는 비치환된 이형고리 그룹, 시아노기, 트리플루오로메틸기, C1 내지 C20의 아민기, C6내지 C20의 방향족 그룹이 치환된 아민기, C5 내지 C20의 이형고리 그룹이 치환된 아민기 및 C1 내지 C20의 실릴기로부터 이루어진 군에서 선택된 어느 하나이다.

대 표 도 - 도1

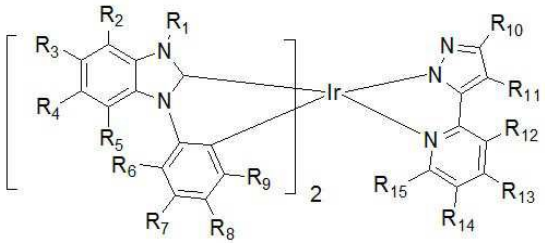


특허청구의 범위

청구항 1

하기 화학식 1로 표시되는 것을 특징으로 하는 청색 인광 화합물.

[화학식 1]

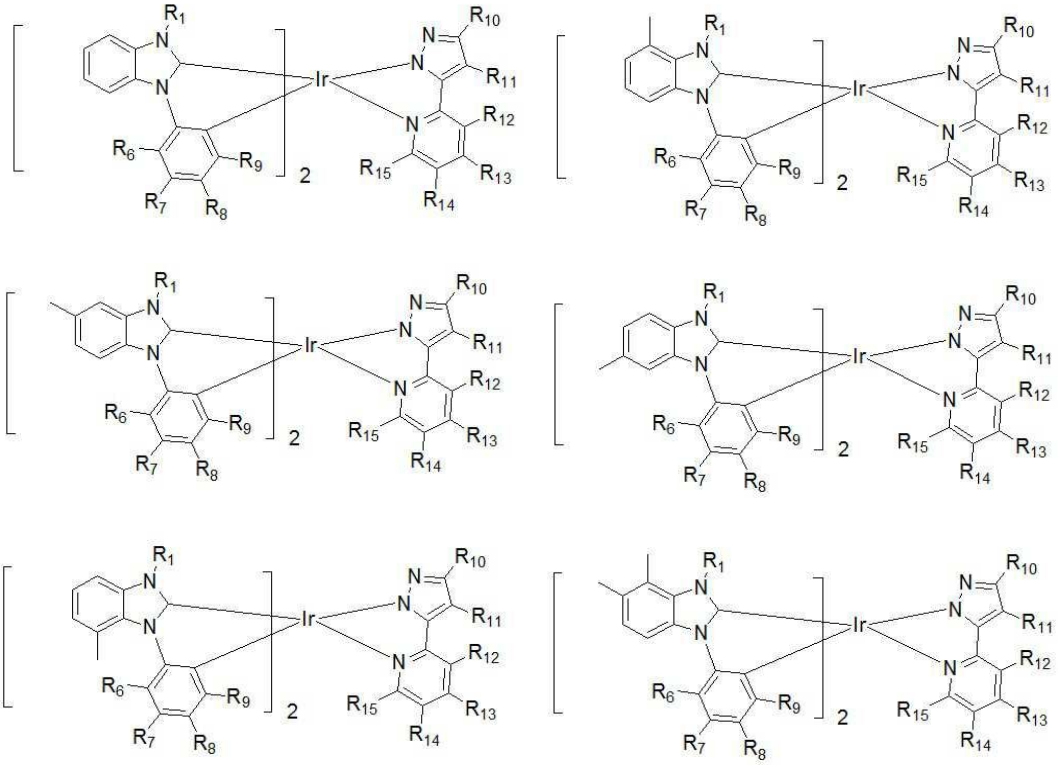


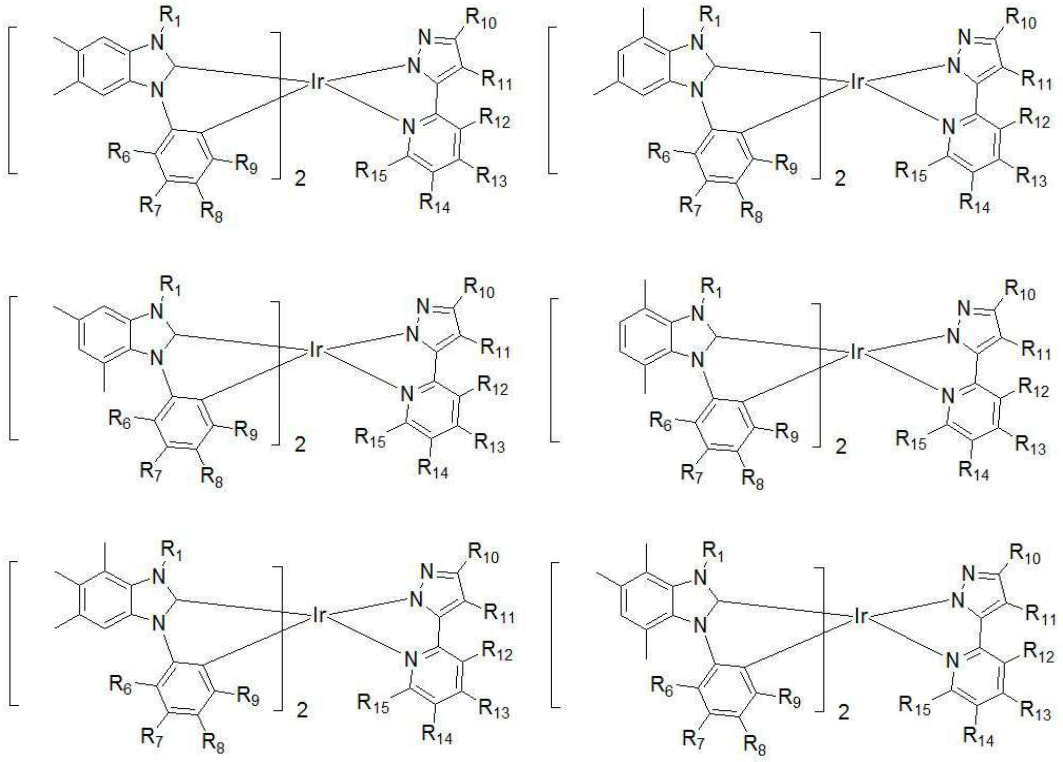
상기 화학식 1에서, R_1 내지 R_{15}는 각각 독립적으로 수소, 중수소. F, Cl, Br의 할로겐, C1 내지 C20의 알킬기, C1 내지 C20의 알콕시기, C1 내지 C20의 사이클로 알킬기, C6 내지 C20의 치환 또는 비치환된 방향족 그룹, C5 내지 C20의 치환 또는 비치환된 이형고리 그룹, 시아노기, 트리플루오로메틸기, C1 내지 C20의 아민기, C6내지 C20의 방향족 그룹이 치환된 아민기, C5 내지 C20의 이형고리 그룹이 치환된 아민기 및 C1 내지 C20의 실릴기로 부터 이루어진 군에서 선택된 어느 하나이다.

청구항 2

제1 항에 있어서,

상기 청색 인광 화합물은 하기 표시되는 화합물들 중 선택된 어느 하나인 것을 특징으로 하는 청색 인광 화합물.

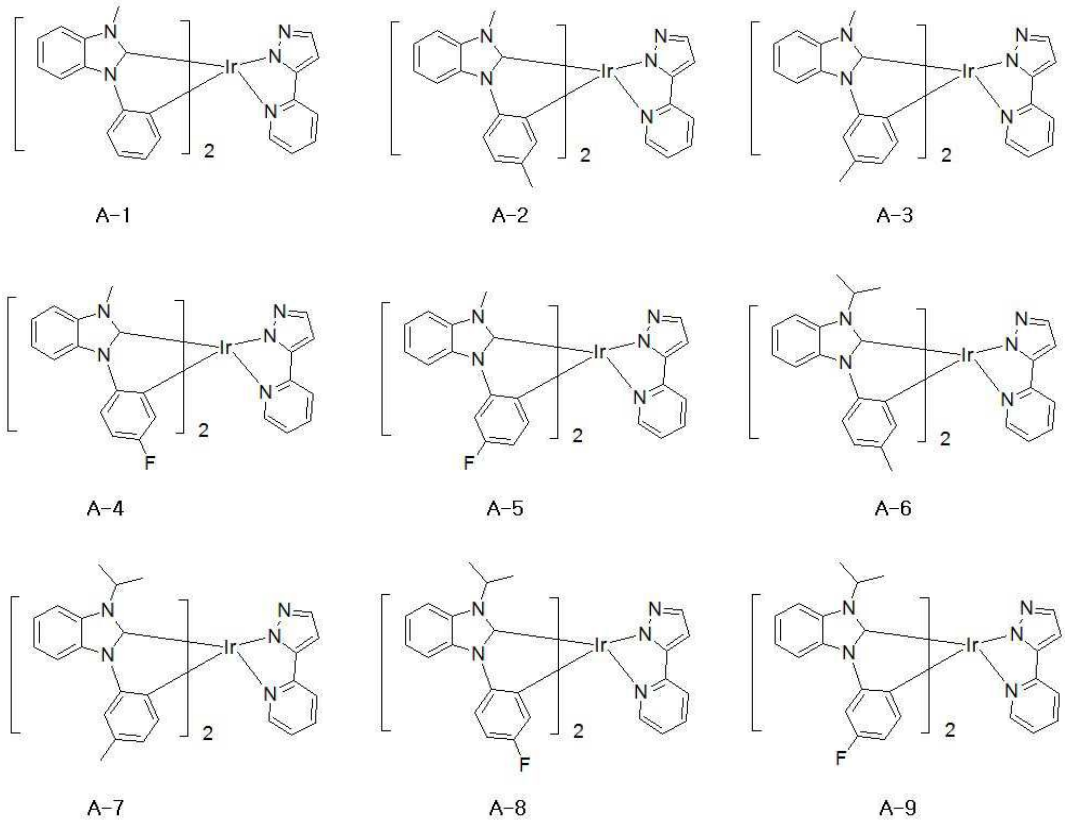




청구항 3

제2 항에 있어서,

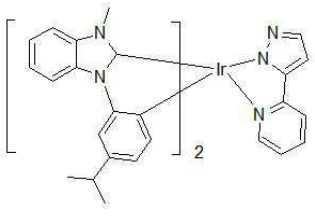
상기 청색 인광 화합물은 하기 표시되는 화합물들 중 선택된 어느 하나인 것을 특징으로 하는 청색 인광 화합물.



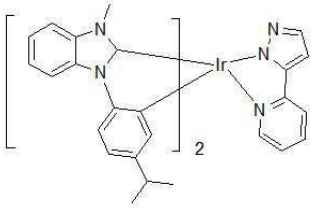
A-1 A-2 A-3

A-4 A-5 A-6

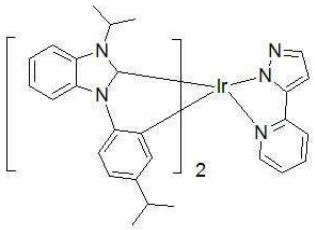
A-7 A-8 A-9



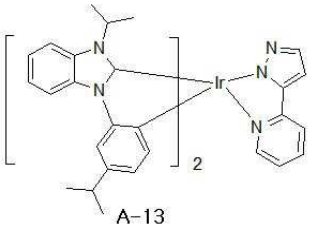
A-10



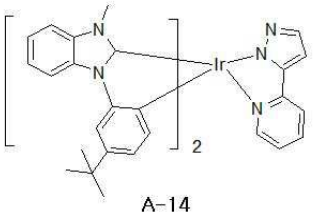
A-11



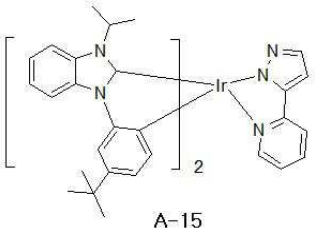
A-12



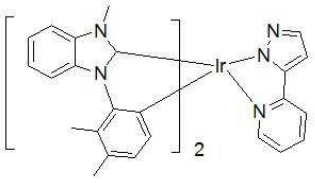
A-13



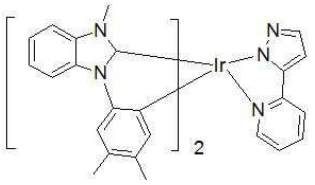
A-14



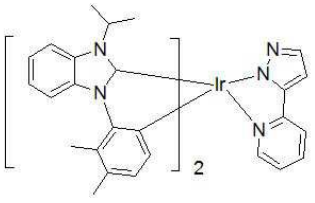
A-15



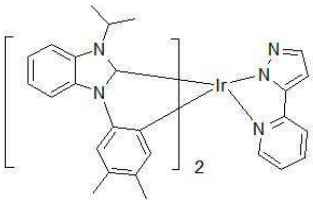
A-16



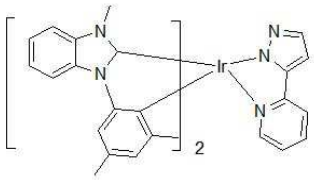
A-17



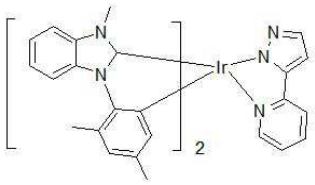
A-18



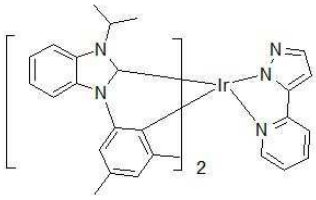
A-19



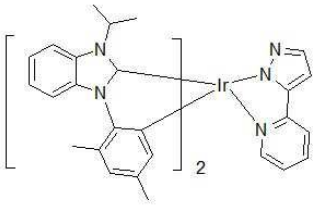
A-20



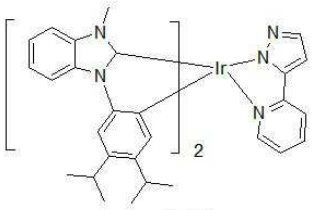
A-21



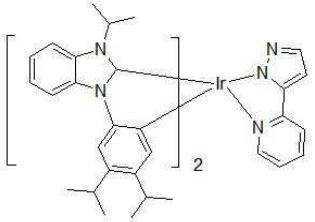
A-22



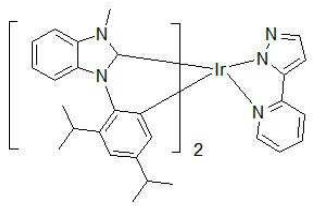
A-23



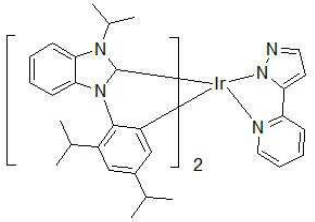
A-24



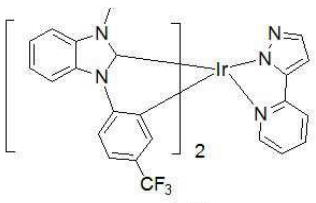
A-25

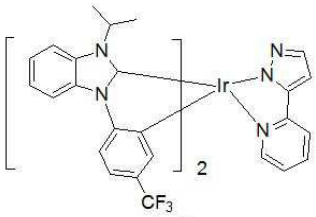


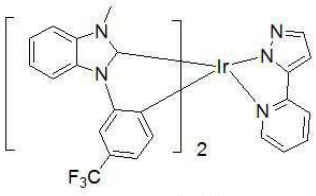
A-26

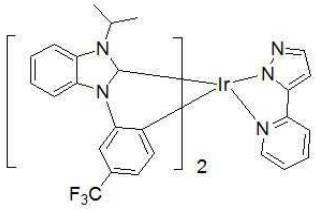


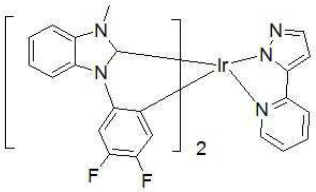
A-27

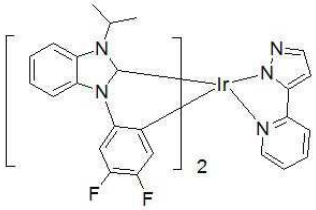

A-28

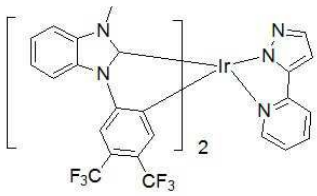

A-29

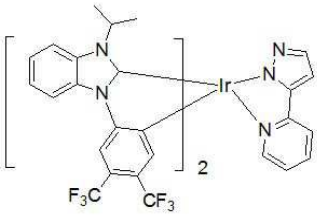

A-30

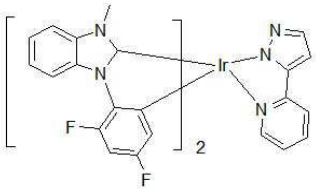

A-31

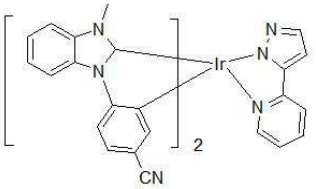

A-32

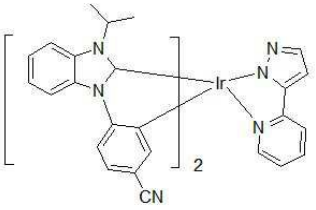

A-33

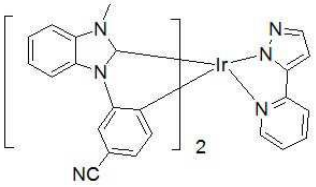

A-34

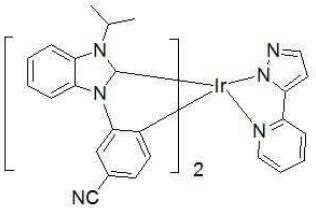

A-35

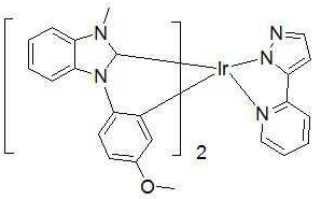

A-36

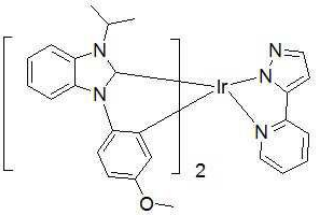

A-37

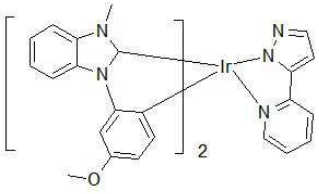

A-38

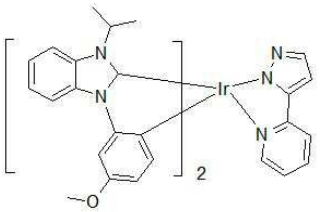

A-39

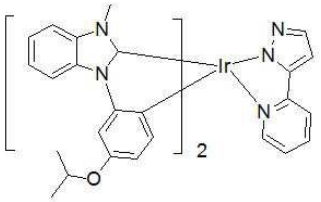

A-40

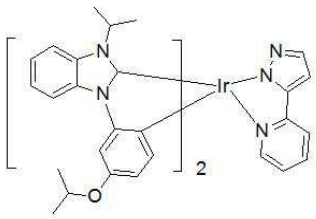

A-41

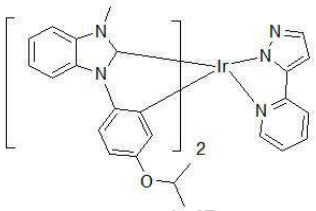

A-42

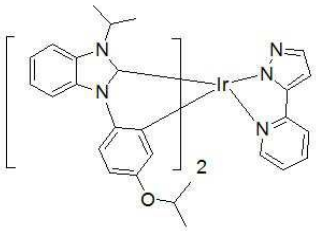

A-43

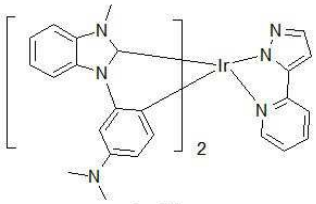

A-44

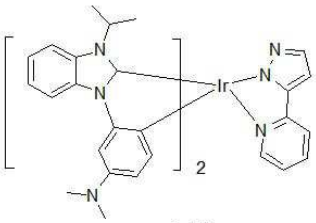

A-45

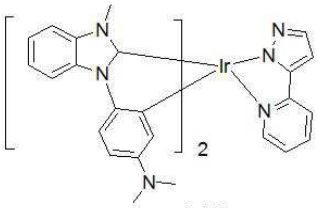

A-46

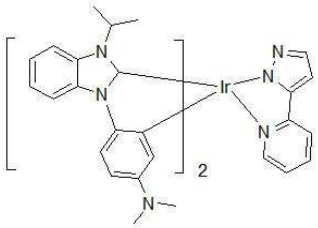

A-47

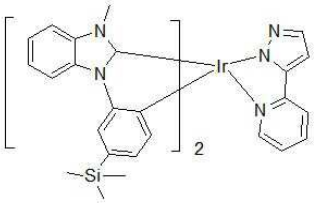

A-48

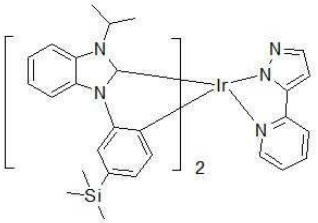

A-49

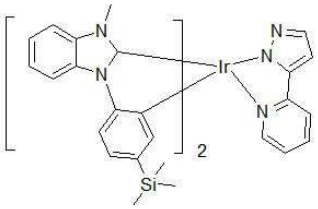

A-50

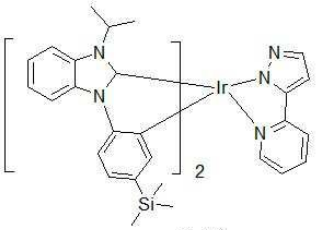

A-51

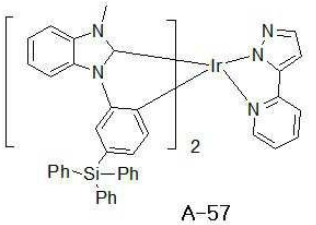

A-52

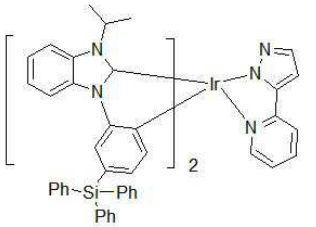

A-53

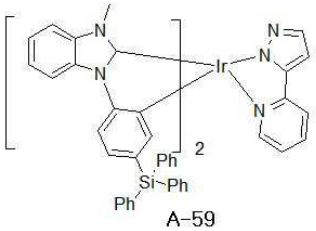

A-54

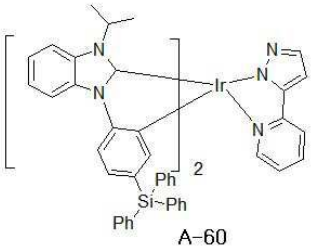

A-55

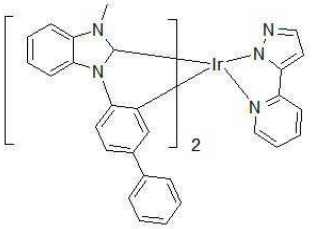

A-56

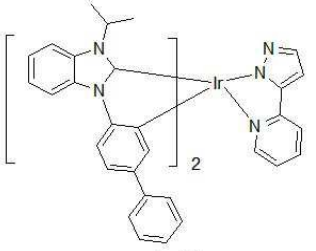

A-57

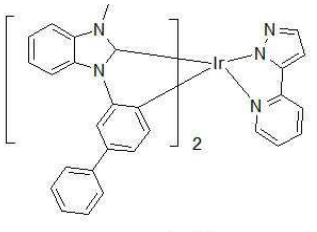

A-58

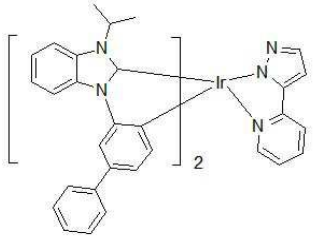

A-59


A-60

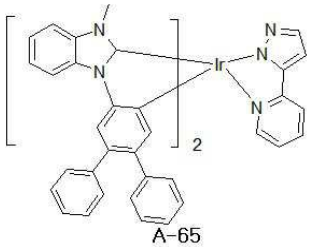

A-61


A-62

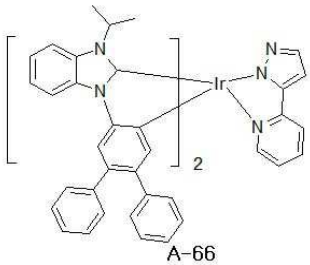

A-63



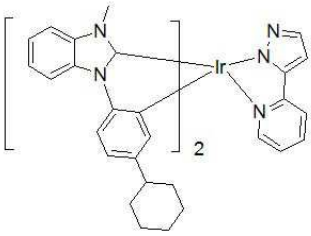
A-64



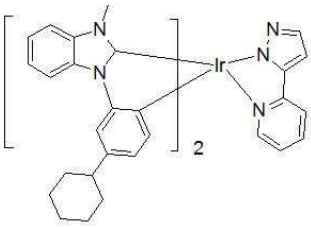
A-65



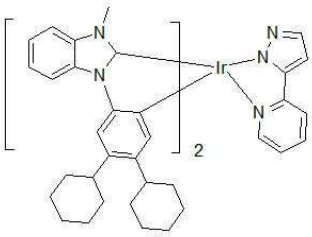
A-66



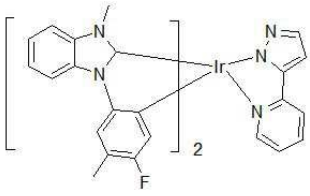
A-67



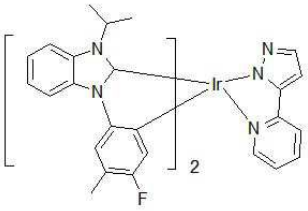
A-68



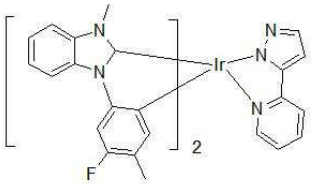
A-69



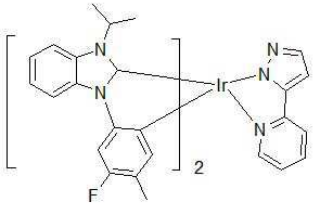
A-70



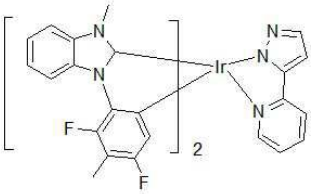
A-71



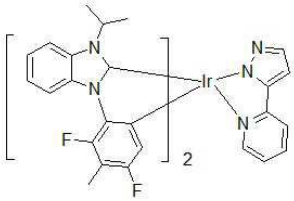
A-72



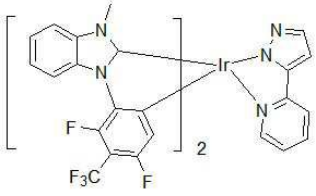
A-73



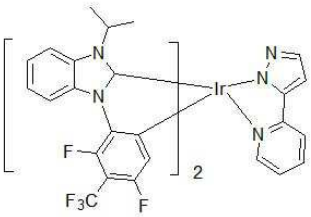
A-74



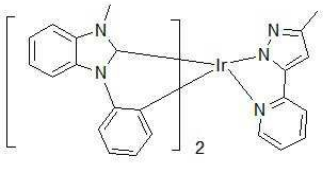
A-75



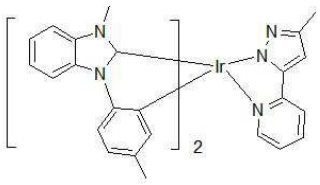
A-76



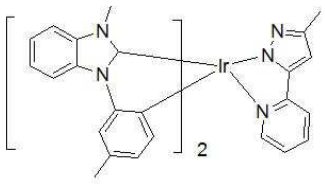
A-77



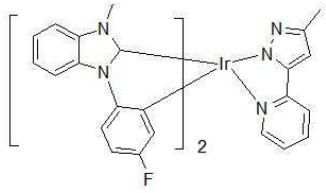
B-1



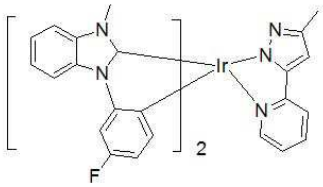
B-2



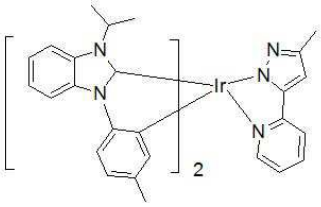
B-3



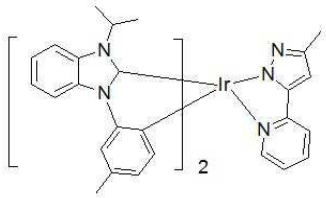
B-4



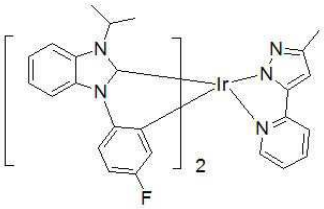
B-5



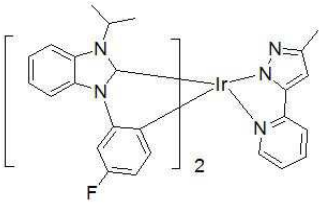
B-6



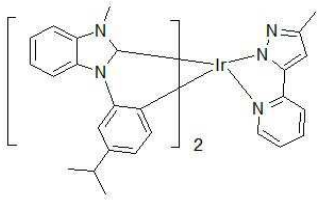
B-7



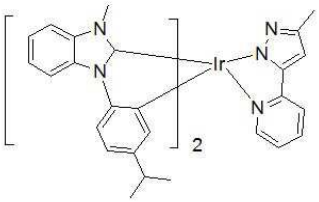
B-8



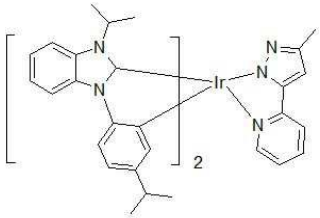
B-9



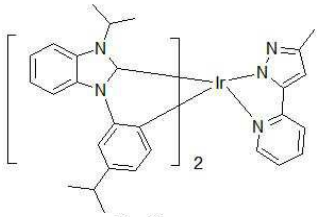
B-10



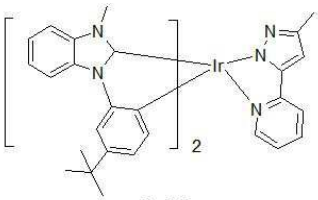
B-11



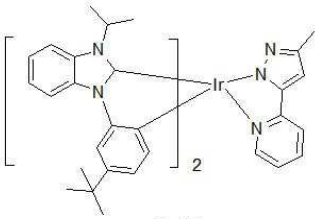
B-12



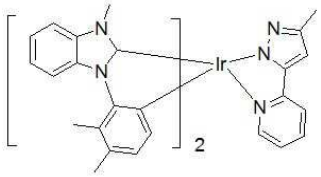
B-13



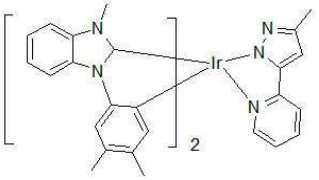
B-14



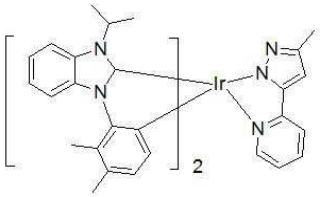
B-15



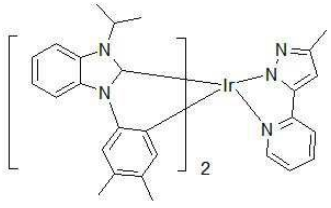
B-16



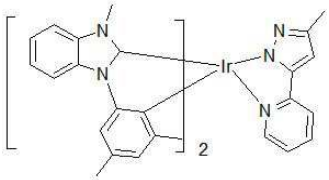
B-17



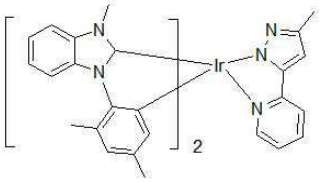
B-18



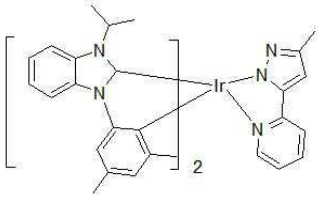
B-19



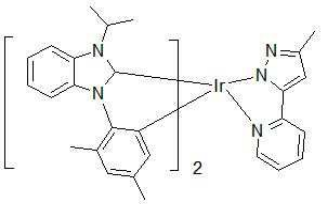
B-20



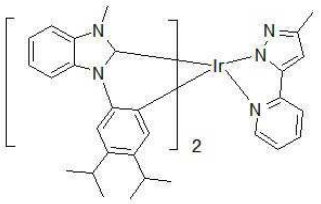
B-21



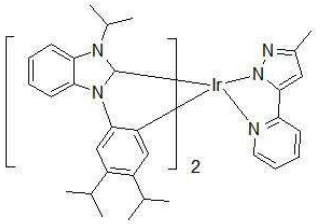
B-22



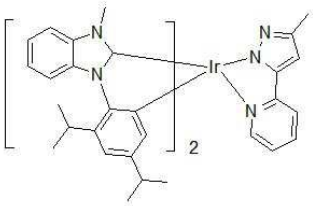
B-23



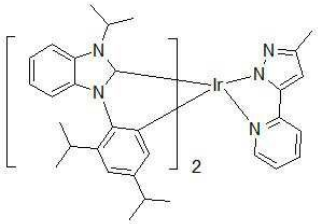
B-24



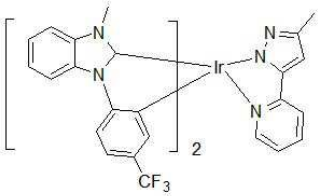
B-25



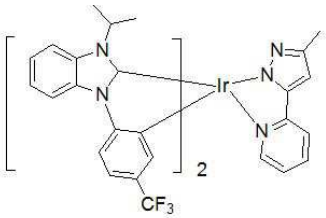
B-26



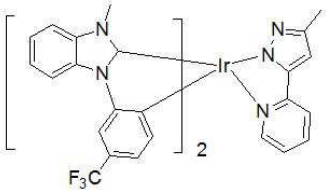
B-27



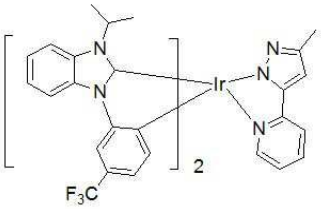
B-28



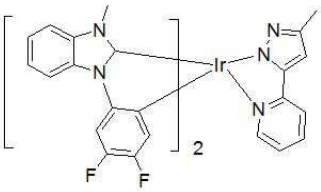
B-29



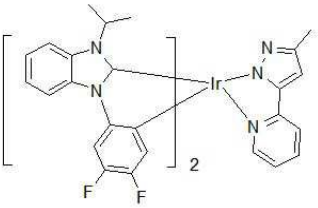
B-30



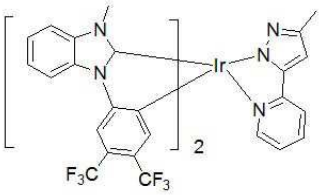
B-31



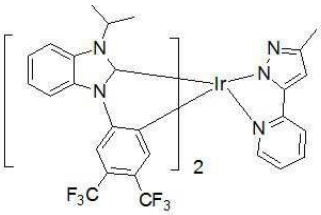
B-32



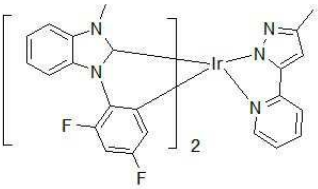
B-33



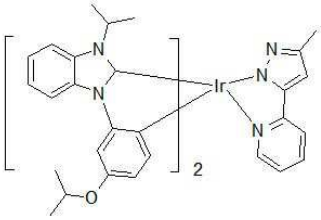
B-34



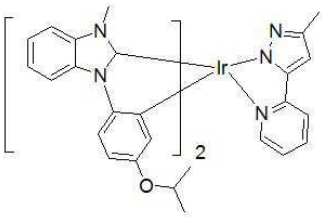
B-35



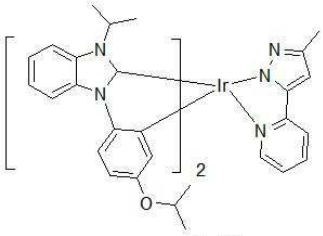
B-36



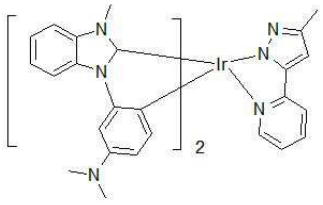
B-37



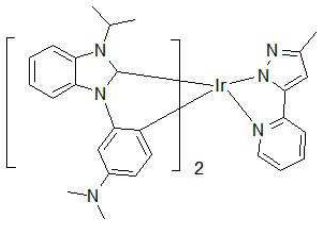
B-38



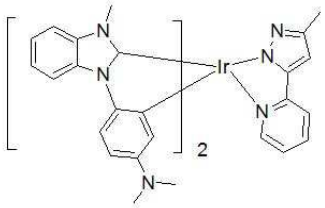
B-39



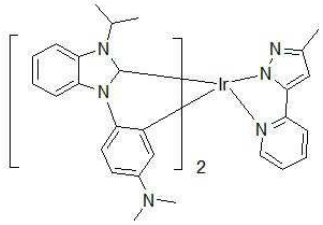
B-40



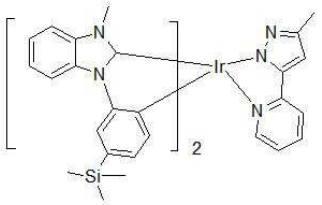
B-41



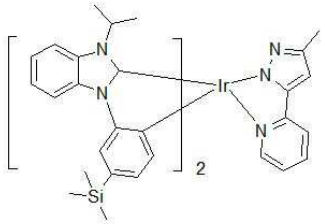
B-42



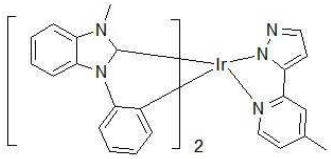
B-43



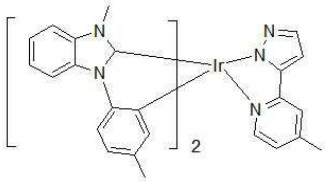
B-44



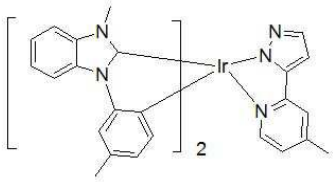
B-45



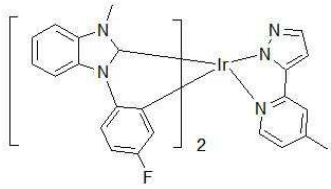
B-46



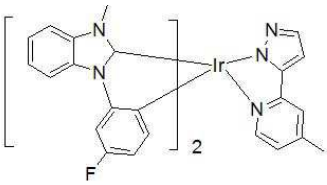
B-47



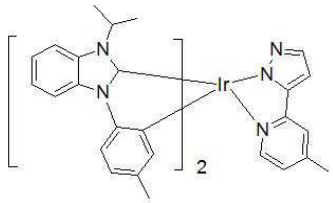
B-48



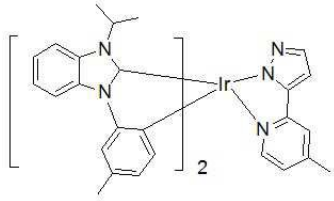
B-49



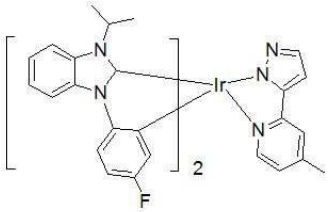
B-50



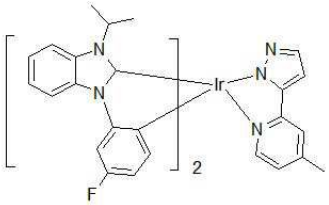
B-51



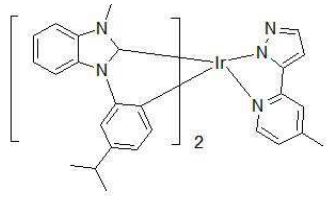
B-52



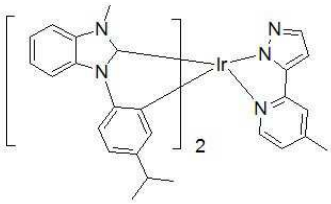
B-53



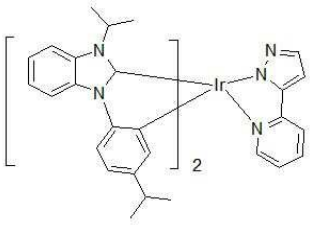
B-54



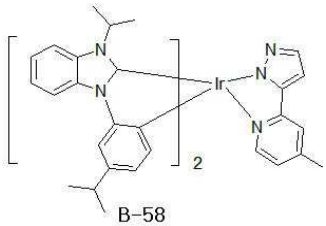
B-55



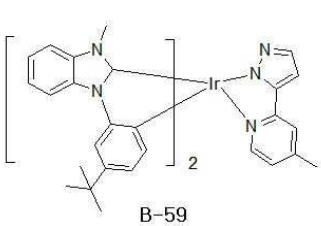
B-56



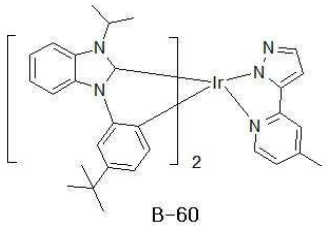
B-57



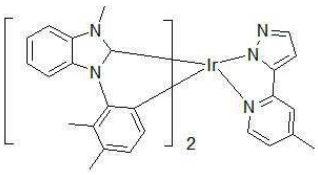
B-58



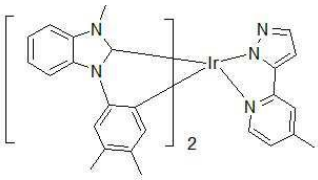
B-59



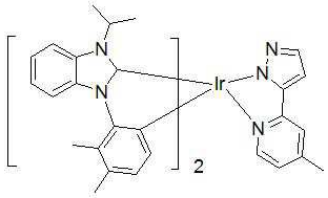
B-60



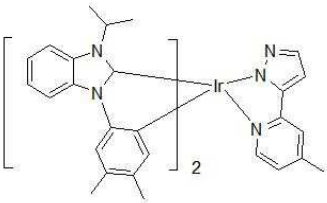
B-61



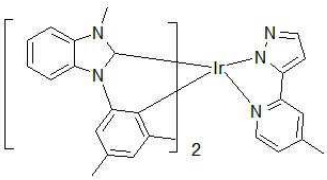
B-62



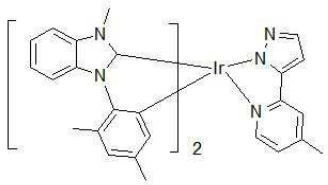
B-63



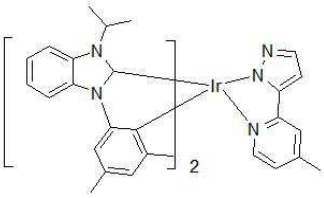
B-64



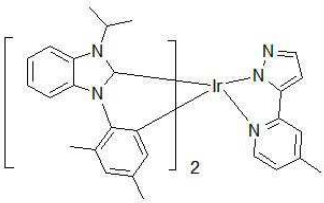
B-65



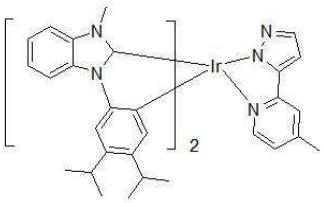
B-66



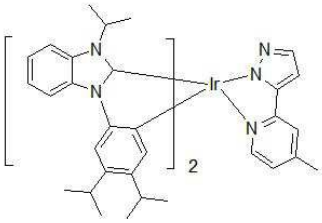
B-67



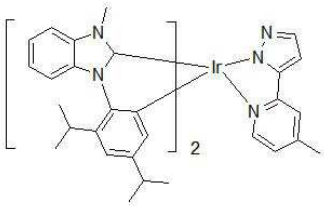
B-68



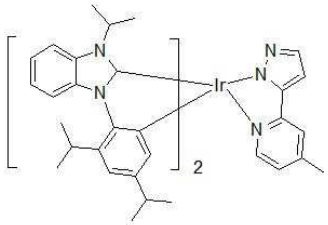
B-69



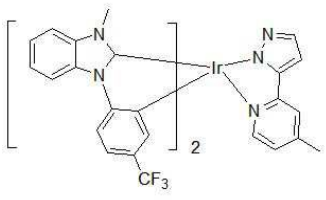
B-70



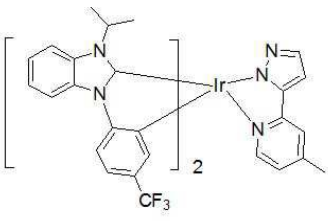
B-71



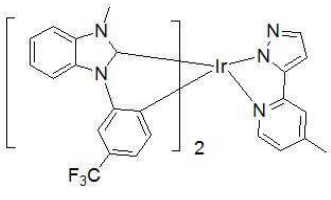
B-72



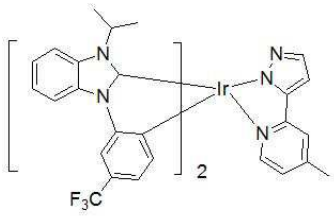
B-73



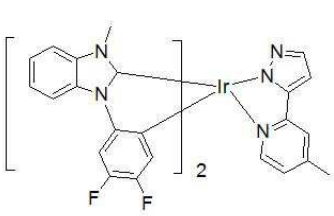
B-74



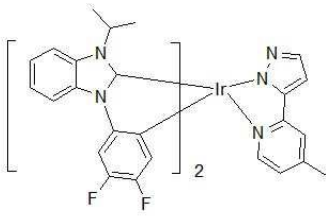
B-75



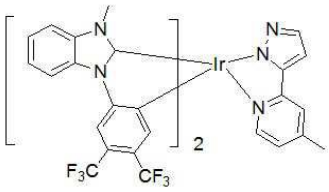
B-76



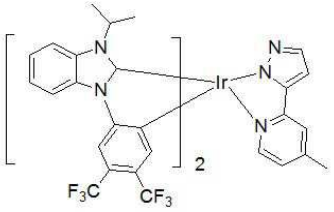
B-77



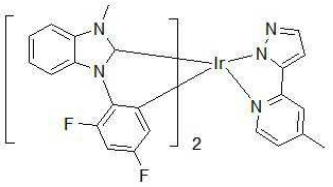
B-78



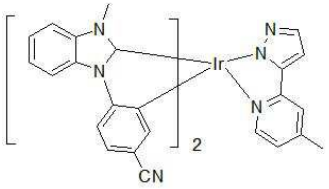
B-79



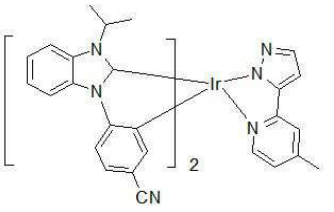
B-80



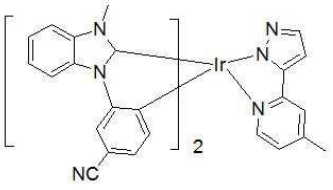
B-81



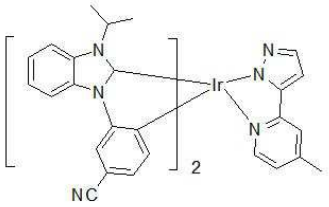
B-82



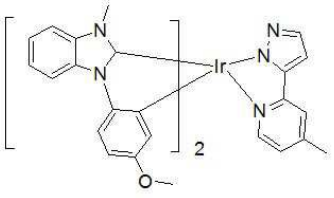
B-83



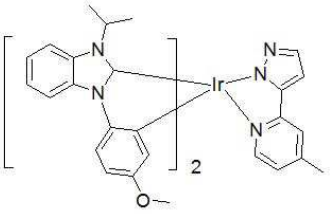
B-84



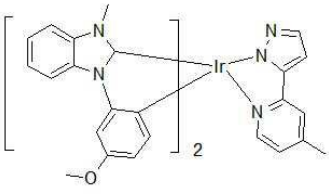
B-85



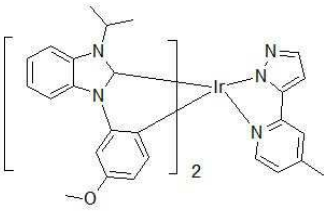
B-86



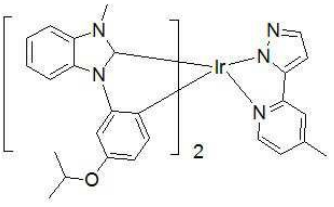
B-87



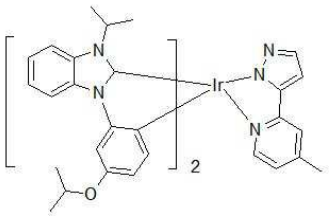
B-88



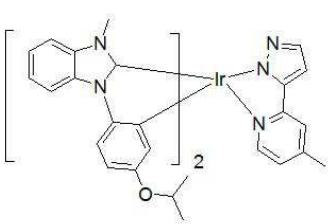
B-89



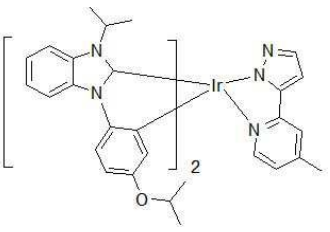
B-90



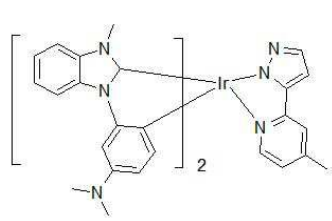
B-91



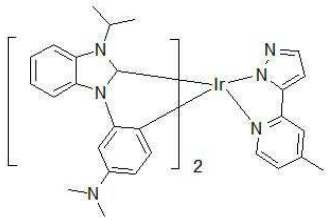
B-92



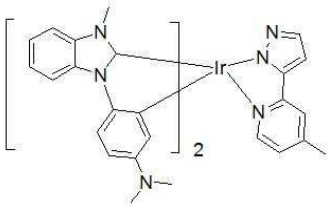
B-93



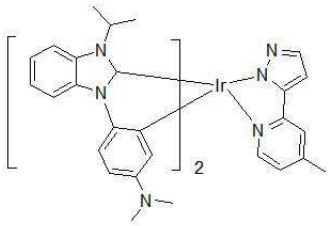
B-94



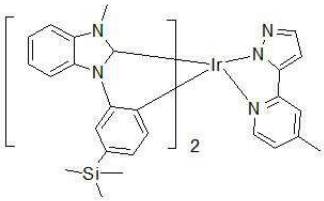
B-95



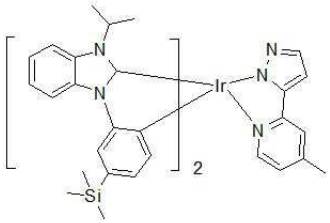
B-96



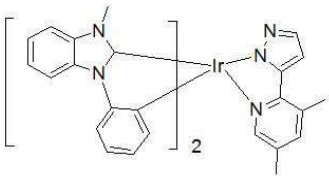
B-97



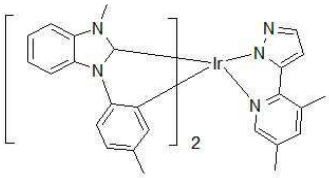
B-98



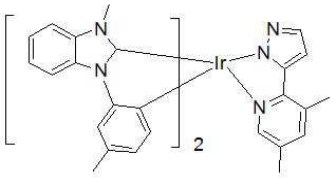
B-99



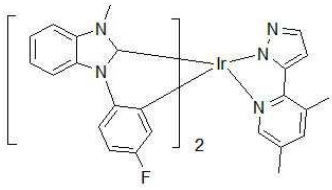
B-100



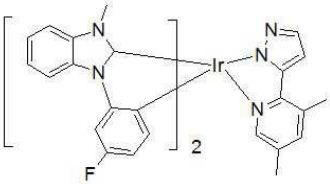
B-101



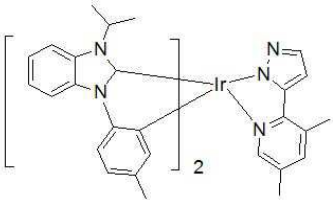
B-102



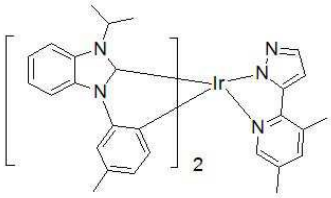
B-103



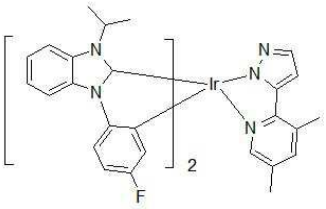
B-104



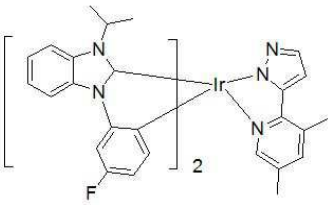
B-105



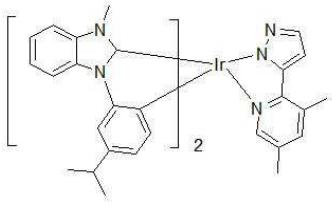
B-106



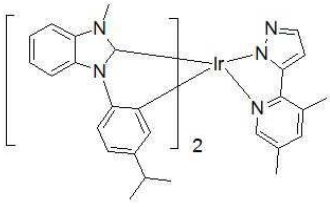
B-107



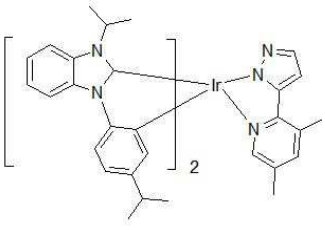
B-108



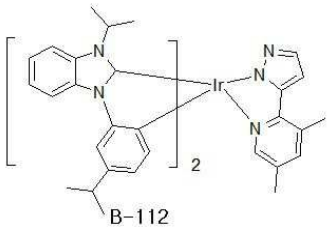
B-109

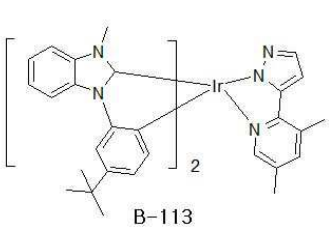


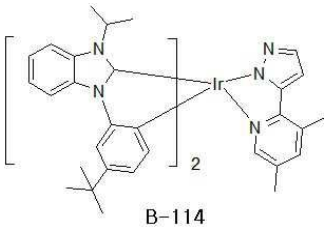
B-110

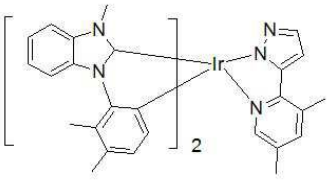


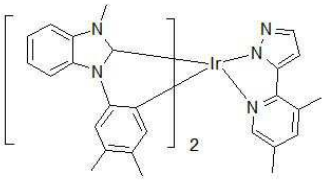
B-111

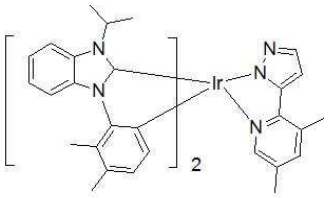

B-112

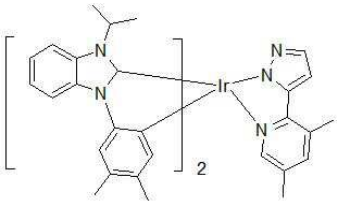

B-113

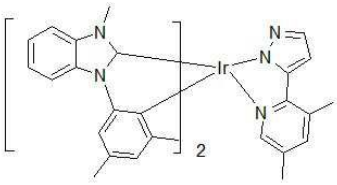

B-114

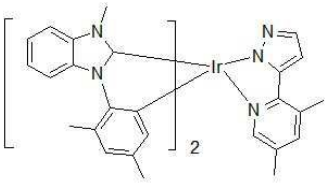

B-115

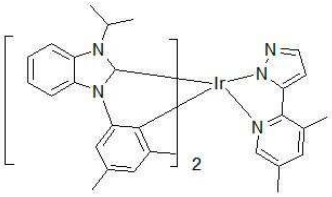

B-116

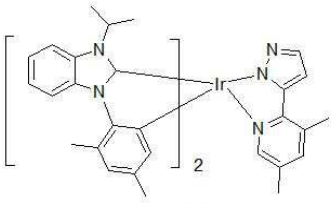

B-117

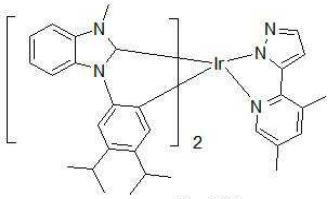

B-118

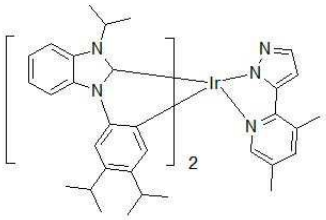

B-119

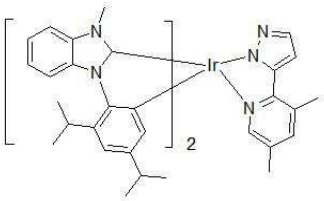

B-120

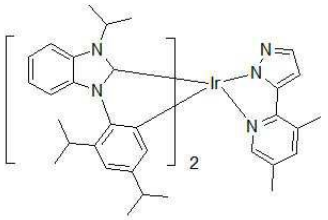

B-121

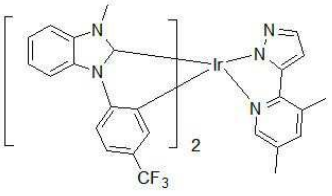

B-122

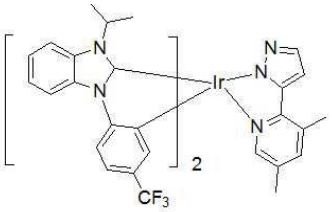

B-123

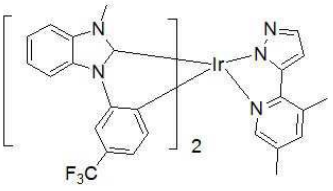

B-124

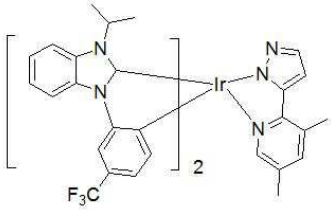

B-125

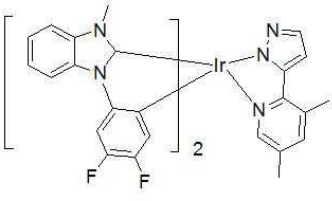

B-126

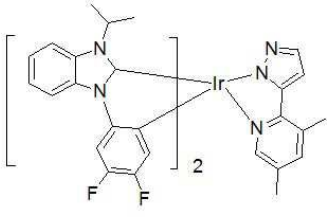

B-127

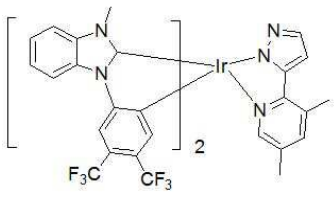

B-128


B-129

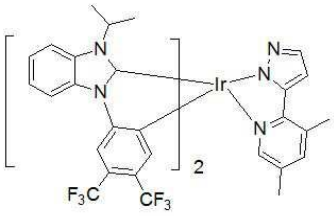

B-140


B-141

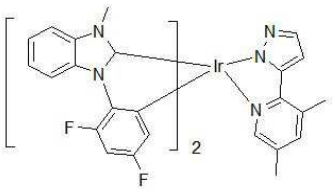

B-142



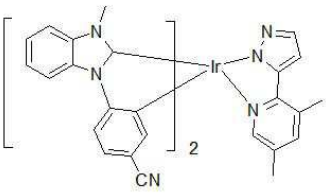
B-143



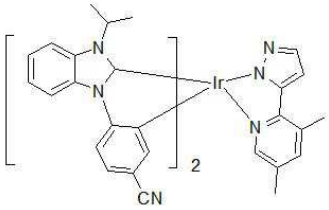
B-144



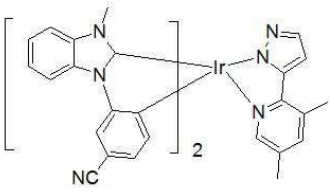
B-145



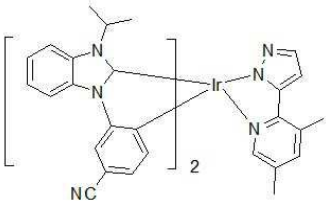
B-146



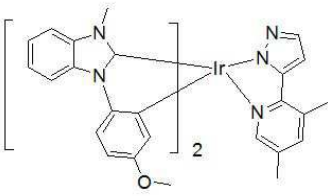
B-147



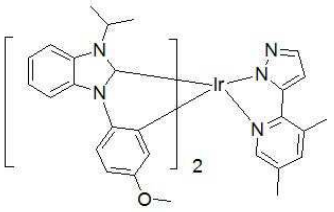
B-148



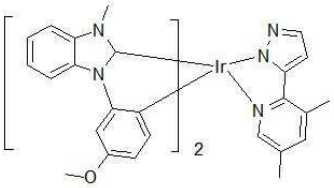
B-149



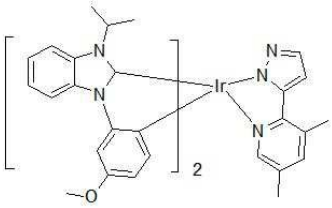
B-150



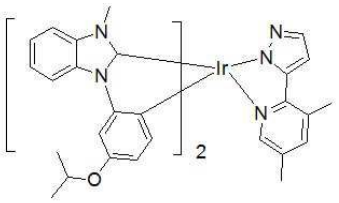
B-151



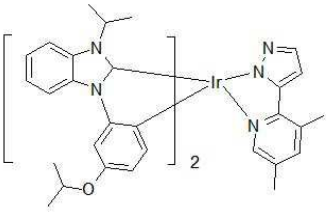
B-152



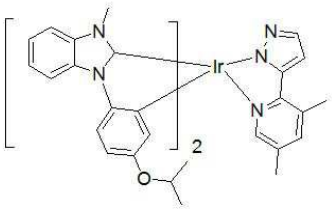
B-153



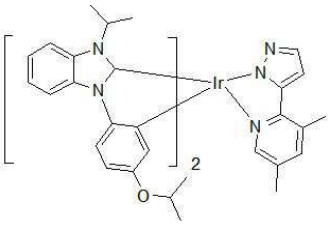
B-154



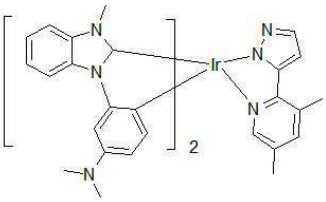
B-155



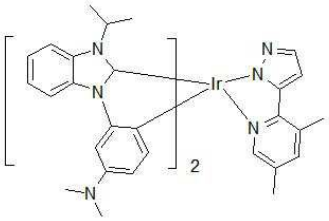
B-156



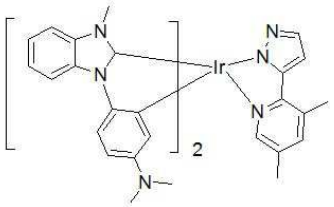
B-157



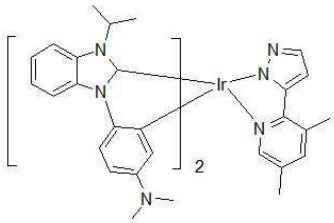
B-158



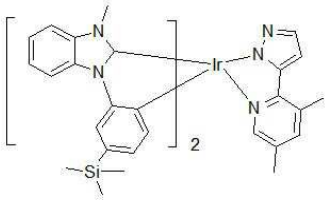
B-159



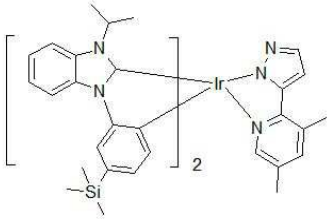
B-160



B-161



B-162



B-163

청구항 4

양극과 음극 사이에 형성된 유기막을 포함하는 유기전계발광소자에 있어서,

상기 유기막이 상기 제1 항 내지 제3 항 중 어느 한 항의 청색 인광 화합물을 포함하는 것을 특징으로 하는 유기전계발광소자.

청구항 5

제4 항에 있어서,

상기 유기막이 발광층인 것을 특징으로 하는 유기전계발광소자.

청구항 6

제5 항에 있어서,

상기 청색 인광 화합물이 상기 발광층의 도펀트로 사용되는 것을 특징으로 하는 유기전계발광소자.

청구항 7

제4 항에 있어서,

상기 양극과 상기 음극 사이에 정공주입층, 정공수송층, 전자수송층 및 전자주입층 중 선택된 어느 하나 이상을 더 포함하는 것을 특징으로 하는 유기전계발광소자.

명 세 서

기 술 분 야

[0001] 본 발명은 청색 인광 화합물 및 이를 사용한 유기전계발광소자에 관한 것으로, 보다 자세하게는, 삼중항 에너지가 높은 고효율 청색 인광 화합물을 유기전계발광소자의 발광층의 도펀트로 사용하는 유기전계발광소자에 관한 것이다.

배 경 기 술

[0002] 최근, 표시장치(FPD: Flat Panel Display)는 멀티미디어의 발달과 함께 그 중요성이 증대되고 있다. 이에 부응하여 액정표시장치(Liquid Crystal Display : LCD), 플라즈마 디스플레이 패널(Plasma Display Panel: PDP), 전계방출표시장치(Field Emission Display: FED), 유기전계발광소자(Organic Light Emitting Diode Device) 등과 같은 여러 가지의 디스플레이가 실용화되고 있다.

[0003] 이 중 유기전계발광소자는 플라스틱 같은 유연한 기판 위에도 소자를 형성할 수 있을 뿐 아니라, 플라즈마 디스플레이 패널이나 무기전계발광 디스플레이에 비해 10V 이하의 낮은 전압에서 구동이 가능하고, 전력소모가 비교

적 적으며 색감이 뛰어나다는 장점이 있다. 또한, 유기전계발광소자는 적색, 녹색 및 청색의 3가지 색을 나타낼 수 있어 풍부한 색을 표현하는 차세대 디스플레이 소자로 많은 사람들의 관심의 대상이 되고 있다.

[0004] 유기전계발광소자는 양극, 정공주입층, 정공수송층, 발광층, 전자수송층, 전자주입층 및 음극을 순차적으로 적층하여 형성할 수 있다. 발광 재료의 경우 양쪽 전극에서부터 주입된 전자와 정공의 재결합에 의해 여기자가 형성되며, 일중항 여기자의 경우 형광, 삼중항 여기자의 경우 인광에 관여하게 된다. 최근에는 형광에서 인광으로 발광 재료가 변경되는 추세에 있다. 이는 형광의 경우 발광층에서 형성되는 엑시톤 중에 약 25%의 단일항만이 빛을 만드는데 사용되고 75%의 삼중항은 대부분 열로 소실되는 반면, 인광 재료는 이를 모두 빛으로 전환 시키는 발광 메카니즘을 가지고 있기 때문이다.

[0005] 인광 소자의 발광 프로세스를 간단히 살펴 보면, 양극으로부터 주입된 홀과 음극으로부터 주입된 전자가 발광층의 호스트 물질에서 만나게 된다. 물론 도펀트에서 바로 홀과 전자쌍이 만나는 경우도 있지만 일반적으로 호스트의 농도가 높기 때문에 많은 양이 호스트에서 만나게 된다. 이때, 호스트에서 형성된 단일항 엑시톤은 도펀트의 단일항 또는 삼중항으로 에너지 전이가 일어나며, 삼중항 엑시톤은 도펀트의 삼중항으로 에너지 전이가 일어나게 된다.

[0006] 일단, 도펀트의 단일항으로 전이된 엑시톤은 다시 Inter system crossing을 통하여 도펀트의 삼중항으로 전이됨으로 모든 엑시톤의 1차 종착지는 도펀트의 삼중항 준위이다. 이렇게 형성된 엑시톤은 그라운드 상태(ground state)로 전이되며 빛을 발생한다. 이때 발광층 앞과 뒤에 인접한 정공 수송층 또는 전자 수송층의 삼중항 에너지가 도펀트의 삼중항 에너지보다 작을 경우는 도펀트 또는 호스트에서 이들 층으로 역 에너지 전이가 발생하여 효율을 급격히 떨어뜨린다. 따라서 발광층의 호스트 재료뿐만 아니라 정공/전자 이동층의 삼중항 에너지도 인광 소자에 있어 매우 중요한 역할을 한다.

[0007] 유기전계발광소자의 고효율화를 위해서는 삼중항 엑시톤까지 모두 발광에 사용할 수 있는 인광 재료들만으로 발광층을 구성하는 것이 바람직하다. 하지만, 청색 인광 재료의 경우 디스플레이 장치에 적합한 수준의 고색순도를 가지는 물질이 개발되어 있지 않기 때문에 고 색순도를 가지는 청색 인광 도펀트 재료의 개발이 요구되고 있다.

발명의 내용

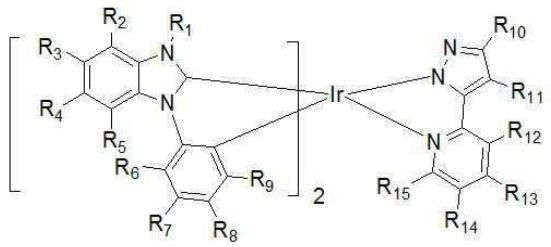
해결하려는 과제

[0008] 따라서, 본 발명은 유기전계발광소자의 발광층에 신규한 청색 인광 화합물을 호스트로서 사용하여, 고효율의 유기전계발광소자를 제공하는데 그 목적이 있다.

과제의 해결 수단

[0009] 상기한 목적을 달성하기 위해, 본 발명의 일 실시예에 따른 청색 인광 화합물은 하기 화학식 1로 표시되는 것을 특징으로 한다.

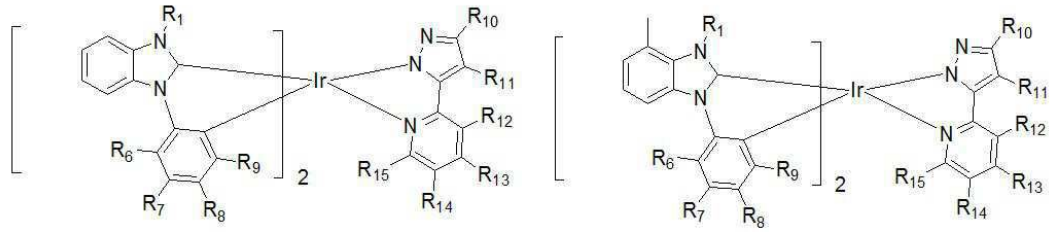
[0010] [화학식 1]

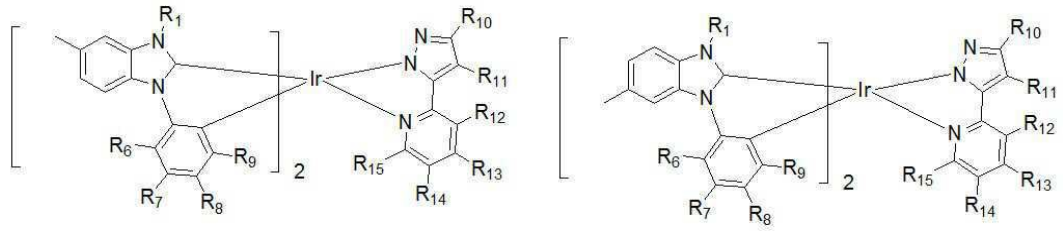
[0011] 

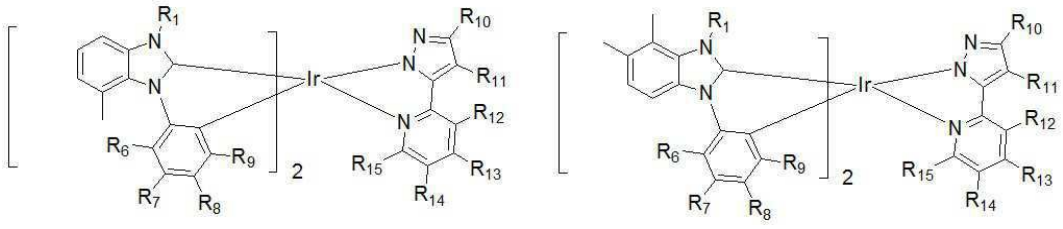
[0012] 상기 화학식 1에서, R_1 내지 R_{15}는 각각 독립적으로 수소, 중수소. F, Cl, Br의 할로겐, C1 내지 C20의 알킬기, C1 내지 C20의 알콕시기, C1 내지 C20의 사이클로 알킬기, C6 내지 C20의 치환 또는 비치환된 방향족 그룹, C5 내지 C20의 치환 또는 비치환된 이형고리 그룹, 시아노기, 트리플루오로메틸기, C1 내지 C20의 아민기, C6내지 C20의 방향족 그룹이 치환된 아민기, C5 내지 C20의 이형고리 그룹이 치환된 아민기 및 C1 내지 C20의 실릴기로

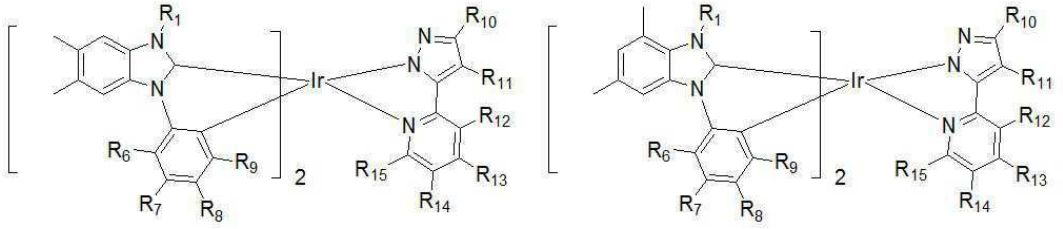
부터 이루어진 군에서 선택된 어느 하나이다.

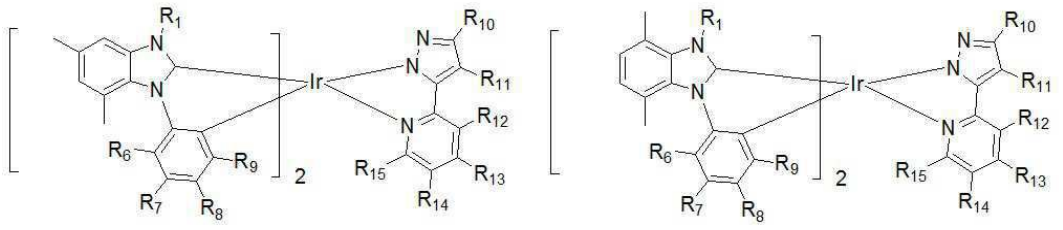
[0013] 상기 청색 인광 화합물은 하기 표시되는 화합물들 중 선택된 어느 하나인 것을 특징으로 한다.

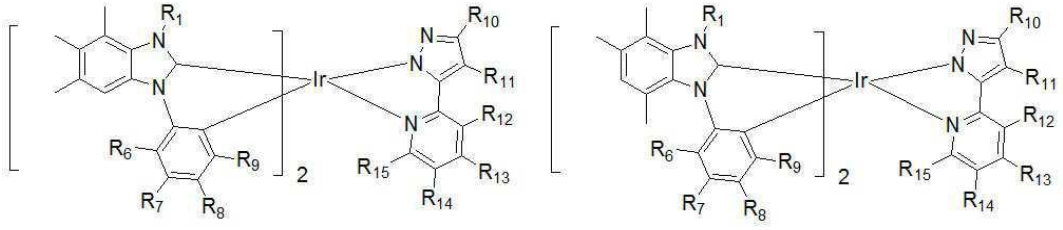
[0014] 

[0015] 

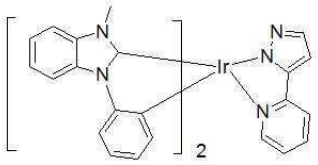
[0016] 

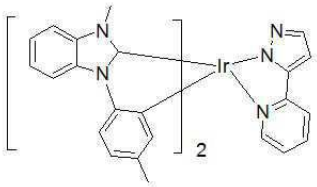
[0017] 

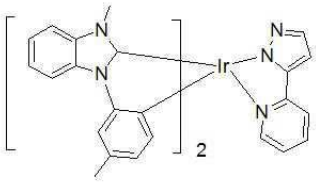
[0018] 

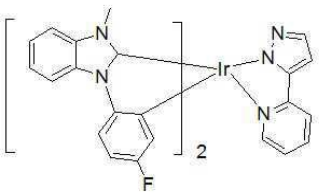
[0019] 

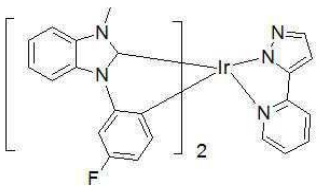
[0020] 상기 청색 인광 화합물은 하기 표시되는 화합물들 중 선택된 어느 하나인 것을 특징으로 한다.

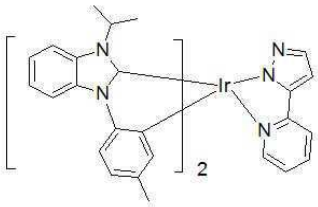
[0021] 
A-1

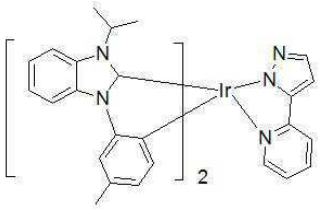

A-2

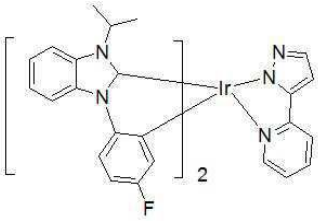

A-3

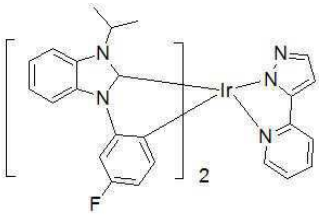
[0022] 
A-4

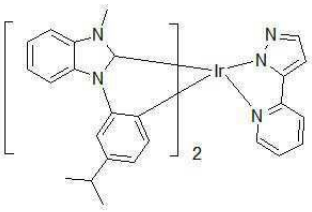

A-5

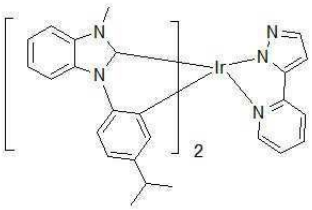

A-6

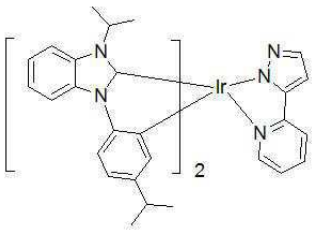
[0023] 
A-7

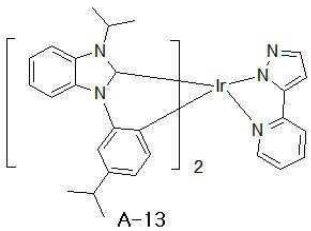

A-8

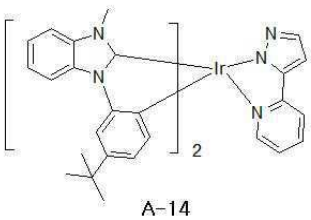

A-9

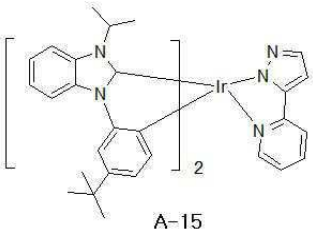
[0024] 
A-10

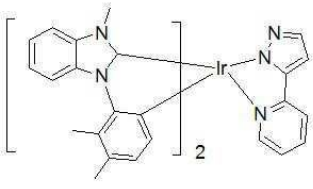

A-11

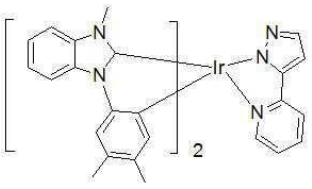

A-12

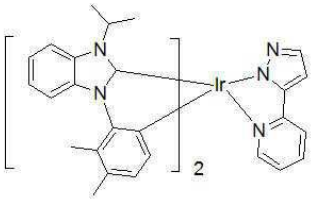
[0025] 
A-13


A-14

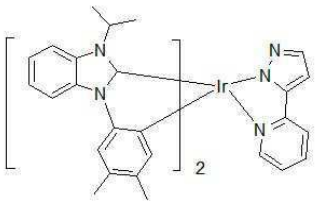

A-15

[0026] 
A-16

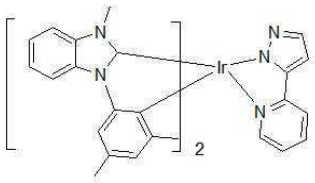

A-17


A-18

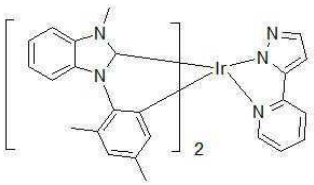
[0027]



A-19

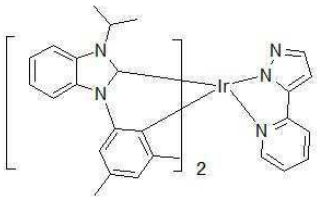


A-20

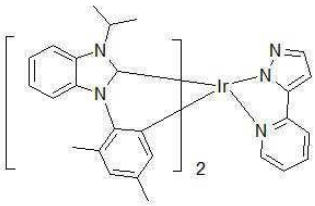


A-21

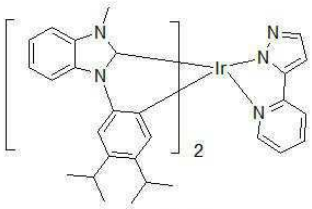
[0028]



A-22

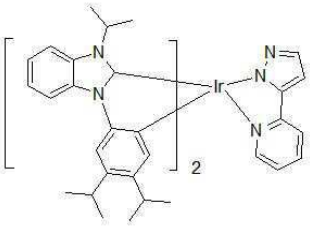


A-23

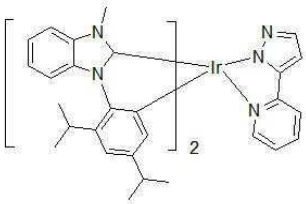


A-24

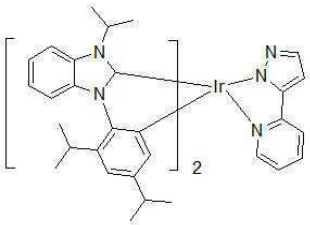
[0029]



A-25

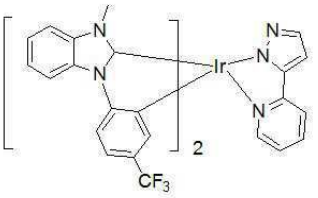


A-26

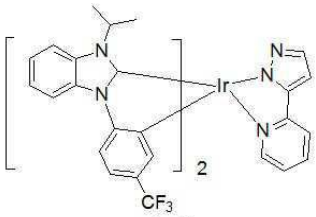


A-27

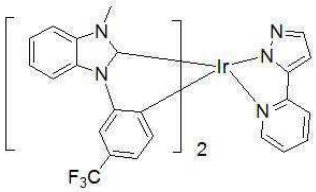
[0030]



A-28

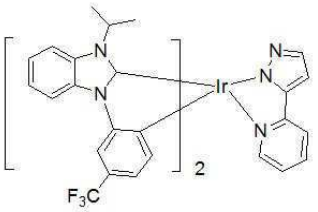


A-29

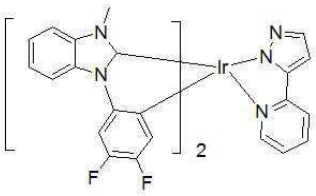


A-30

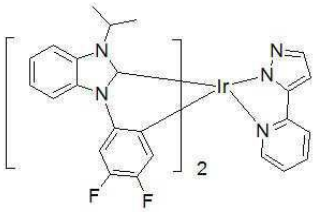
[0031]



A-31

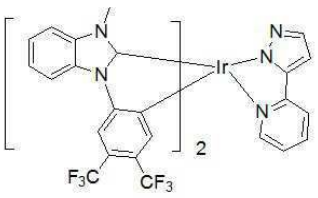


A-32

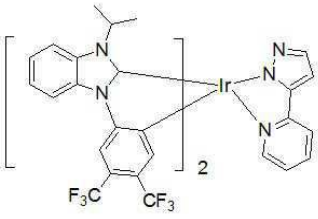


A-33

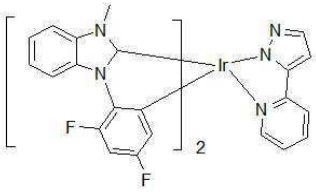
[0032]



A-34

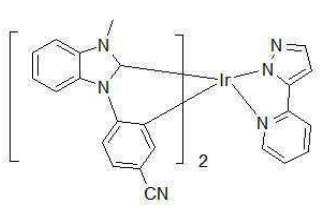


A-35

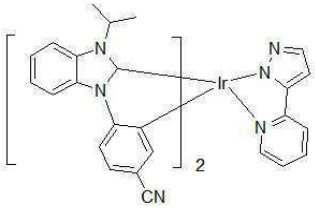


A-36

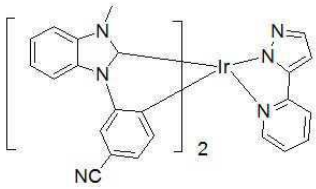
[0033]



A-37

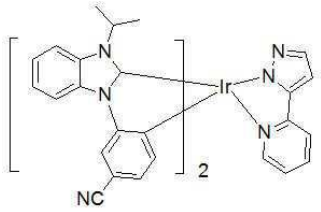


A-38

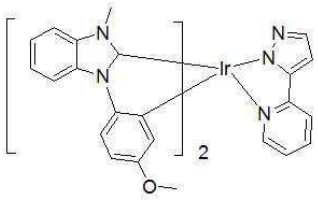


A-39

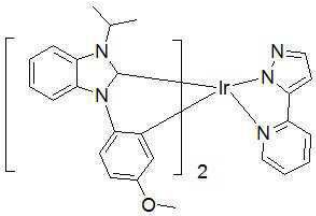
[0034]



A-40

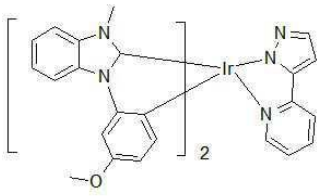


A-41

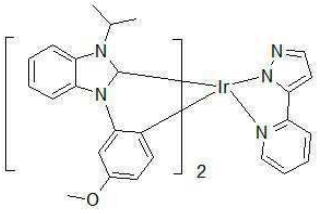


A-42

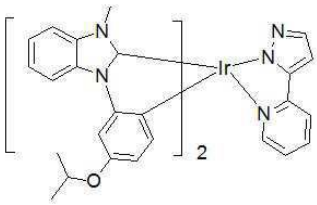
[0035]



A-43

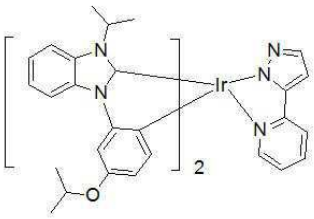


A-44

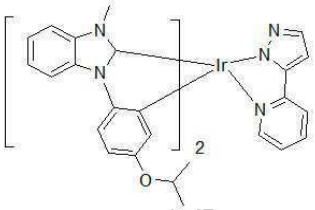


A-45

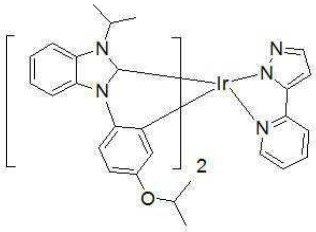
[0036]



A-46

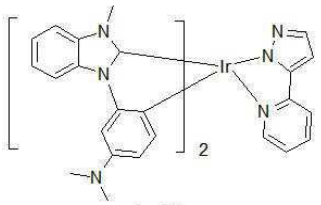


A-47

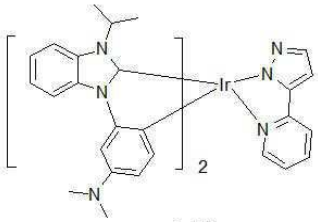


A-48

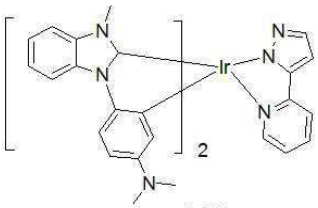
[0037]



A-49

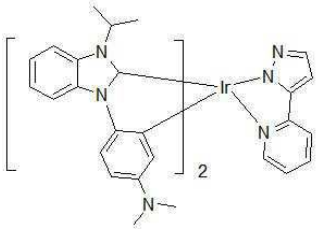


A-50

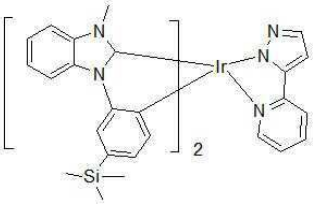


A-51

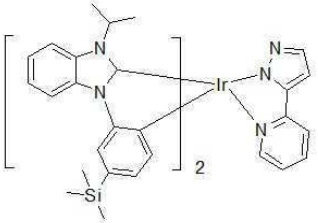
[0038]



A-52

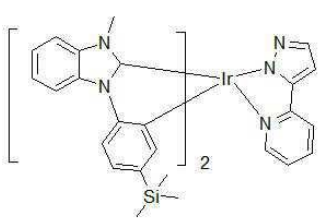


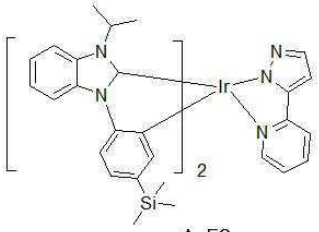
A-53

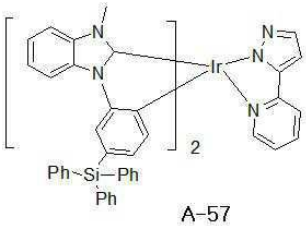


A-54

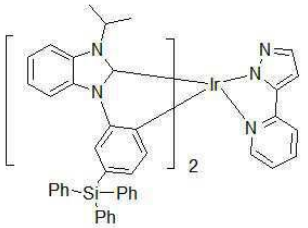
[0039]

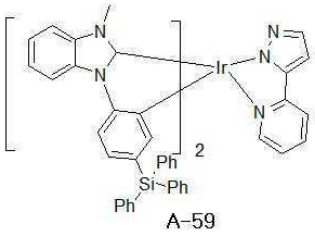

A-55

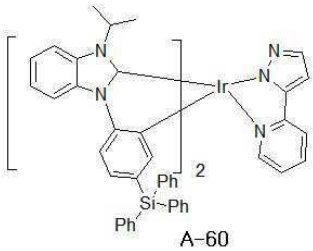

A-56


A-57

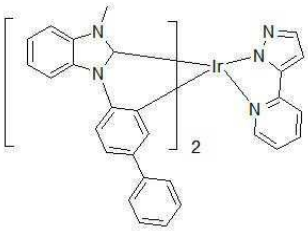
[0040]

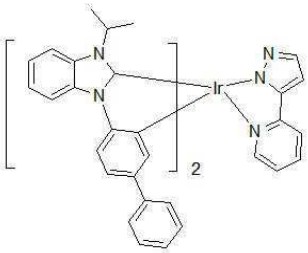

A-58

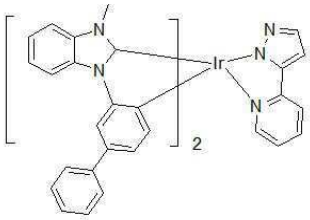

A-59


A-60

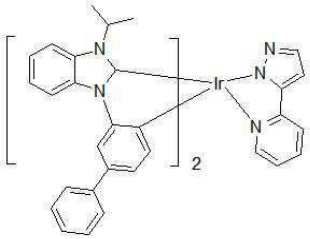
[0041]

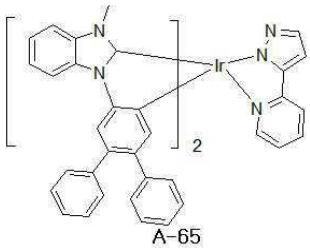

A-61

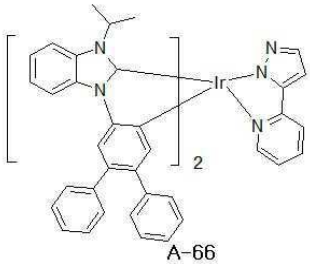

A-62


A-63

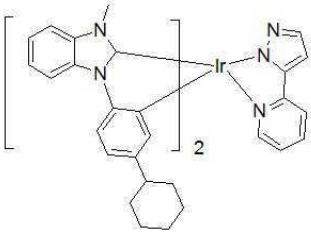
[0042]

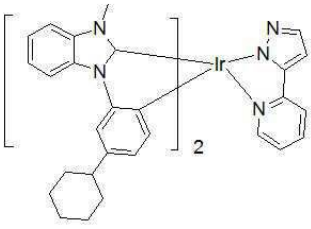

A-64

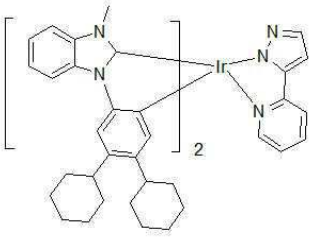

A-65


A-66

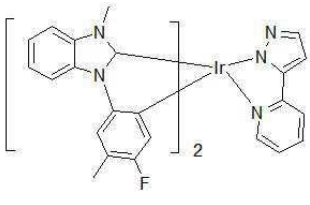
[0043]

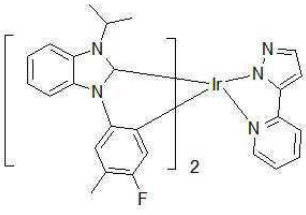

A-67

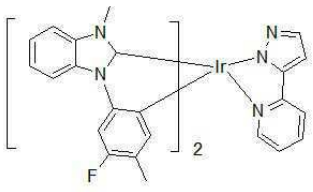

A-68


A-69

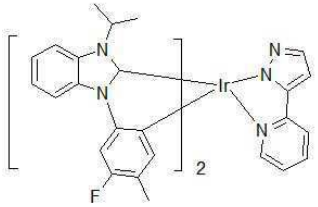
[0044]


A-70

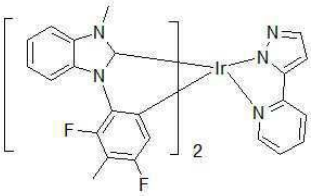

A-71


A-72

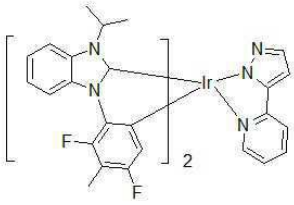
[0045]



A-73

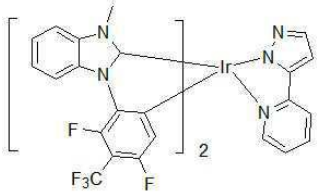


A-74

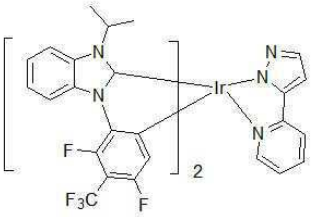


A-75

[0046]

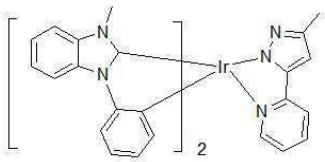


A-76

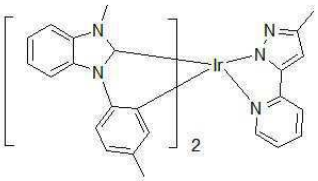


A-77

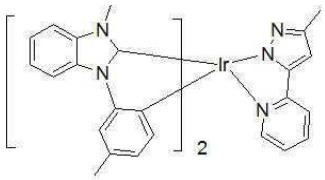
[0047]



B-1

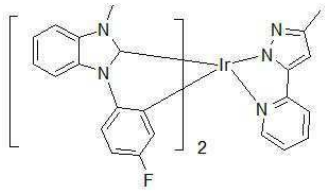


B-2

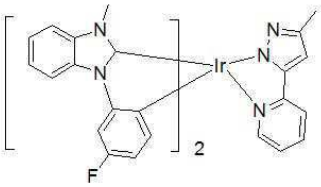


B-3

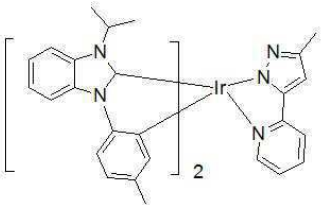
[0048]



B-4

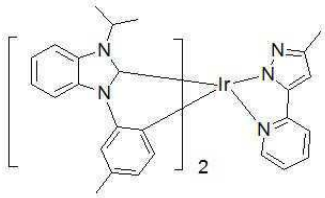


B-5

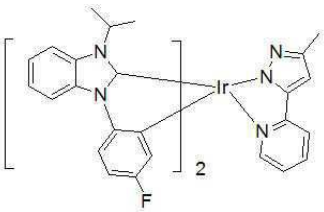


B-6

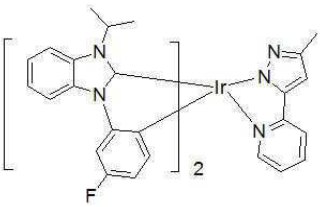
[0049]



B-7

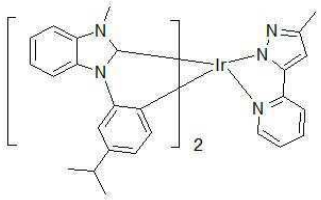


B-8

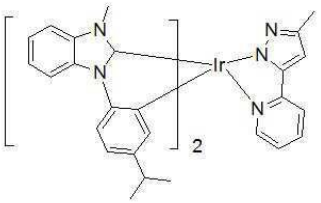


B-9

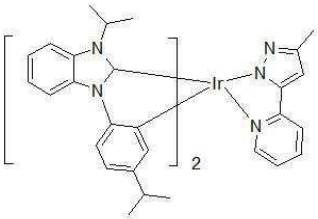
[0050]



B-10

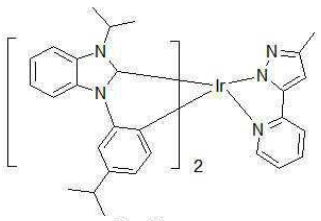


B-11

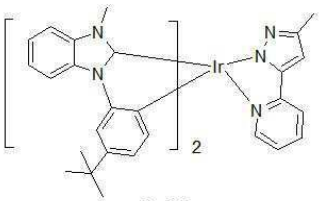


B-12

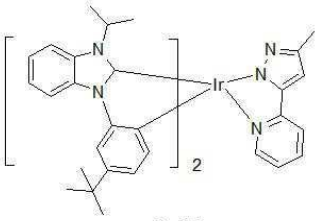
[0051]



B-13

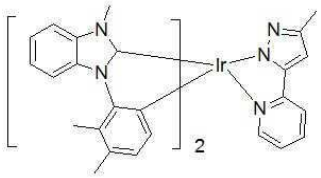


B-14

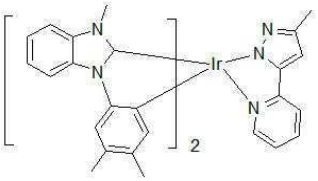


B-15

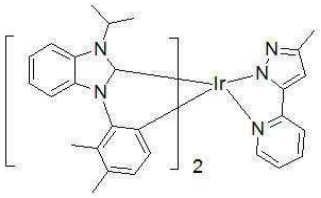
[0052]



B-16

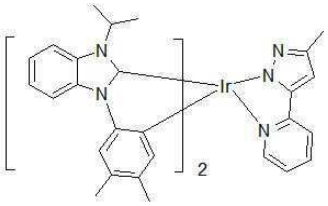


B-17

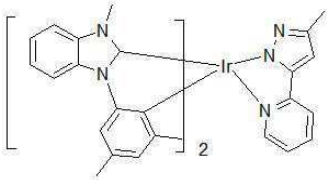


B-18

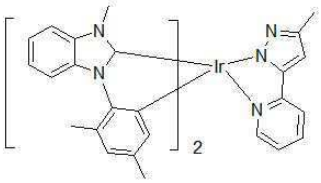
[0053]



B-19

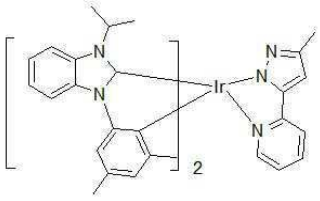


B-20

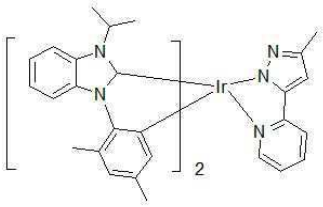


B-21

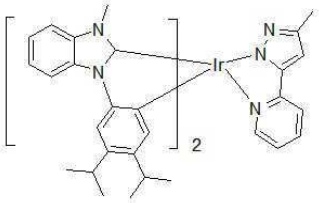
[0054]



B-22

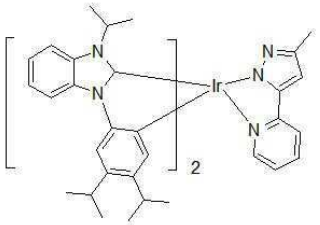


B-23

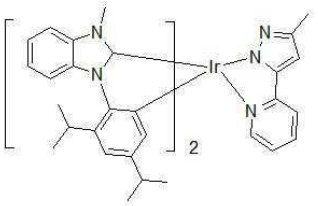


B-24

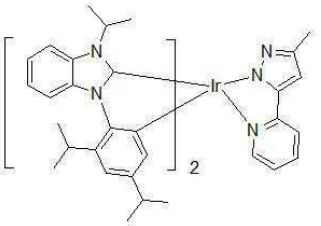
[0055]



B-25

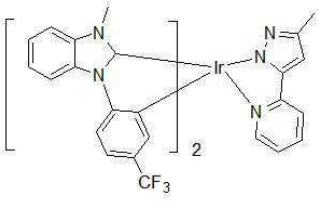


B-26

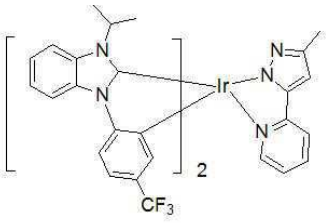


B-27

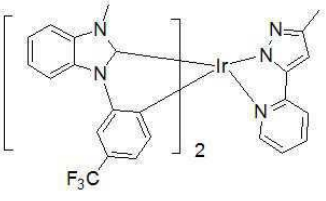
[0056]



B-28

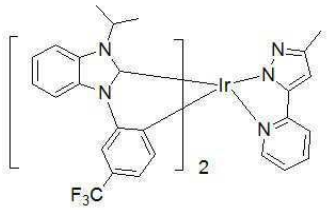


B-29

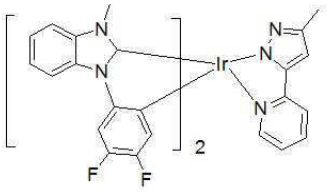


B-30

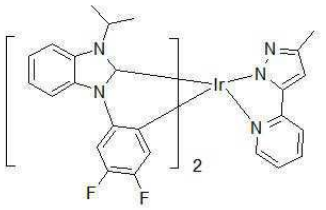
[0057]



B-31

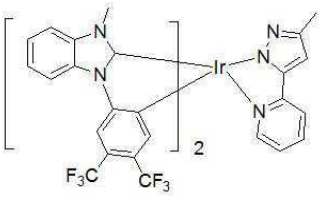


B-32

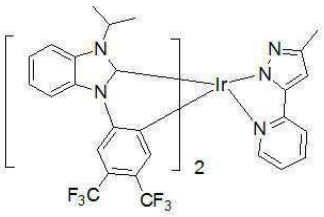


B-33

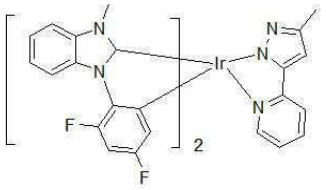
[0058]



B-34

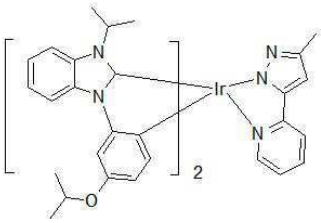


B-35

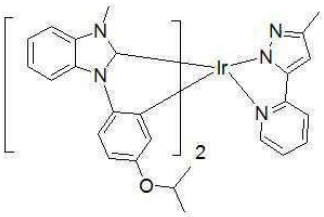


B-36

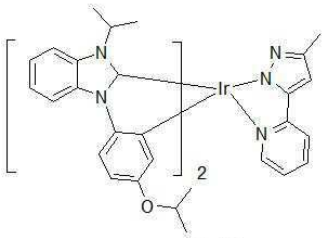
[0059]



B-37

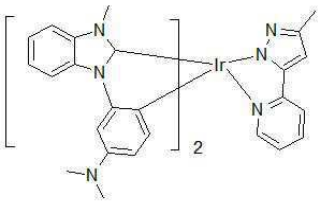


B-38

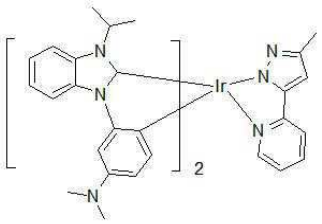


B-39

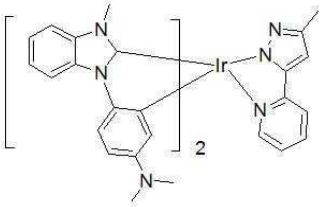
[0060]



B-40

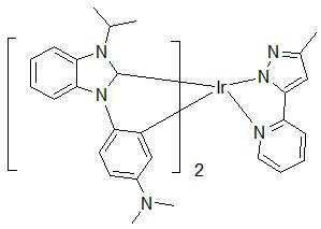


B-41

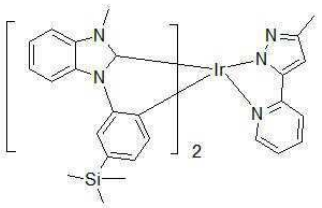


B-42

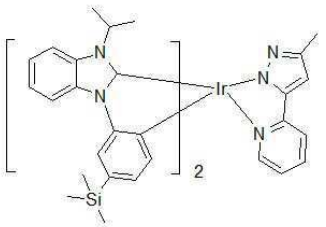
[0061]



B-43

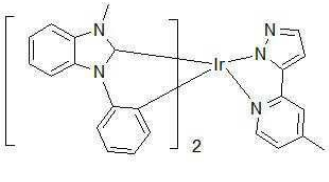


B-44

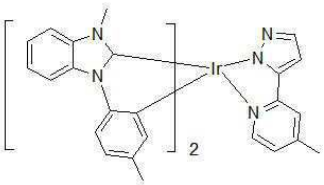


B-45

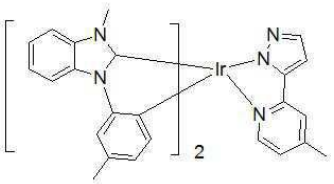
[0062]



B-46

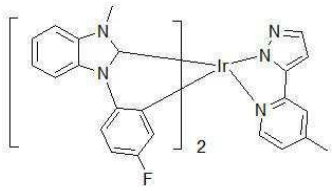


B-47

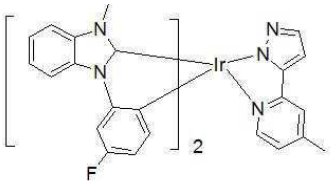


B-48

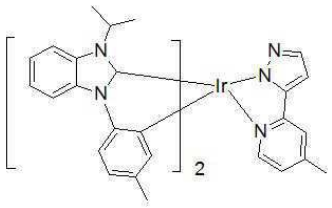
[0063]



B-49

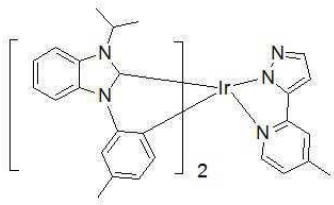


B-50

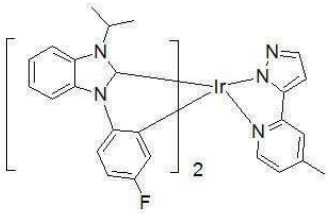


B-51

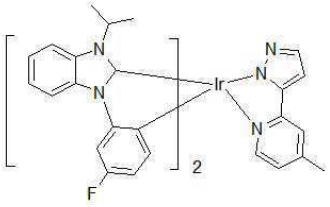
[0064]



B-52

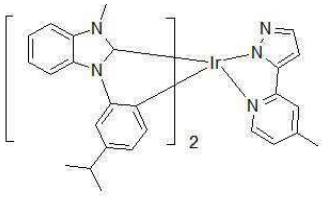


B-53

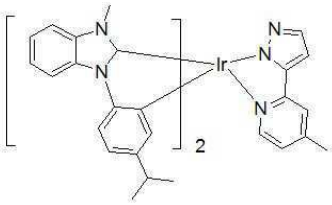


B-54

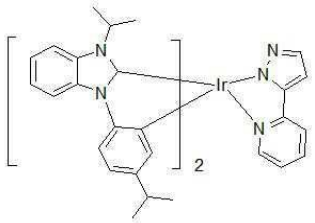
[0065]



B-55

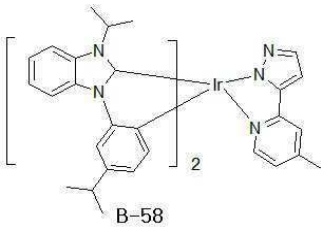


B-56

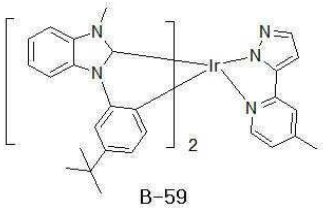


B-57

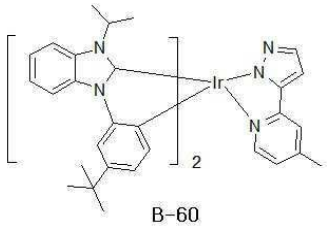
[0066]



B-58

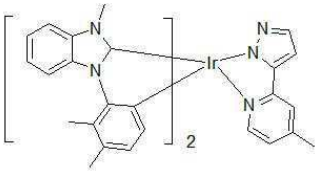


B-59

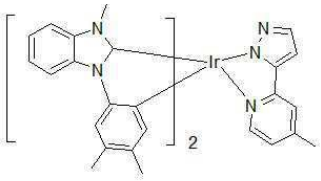


B-60

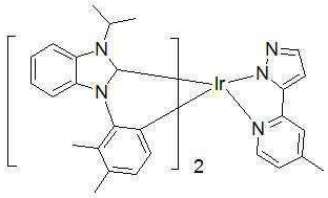
[0067]



B-61

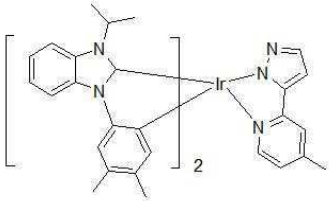


B-62

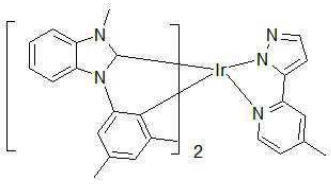


B-63

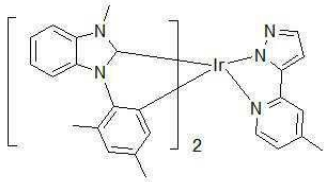
[0068]



B-64

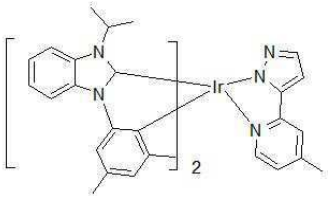


B-65

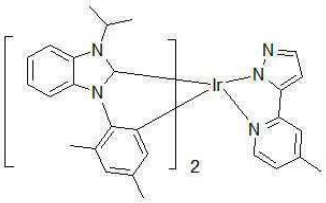


B-66

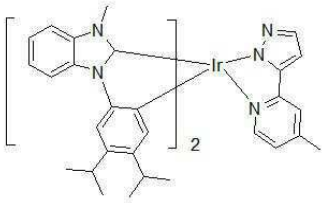
[0069]



B-67

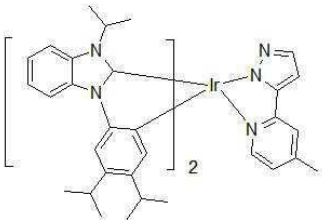


B-68

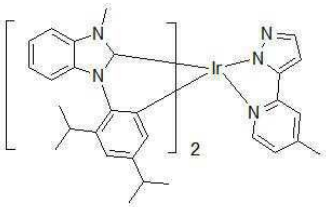


B-69

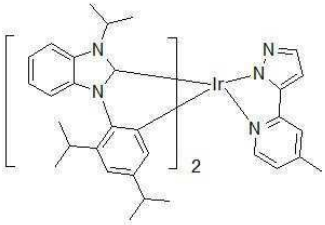
[0070]



B-70

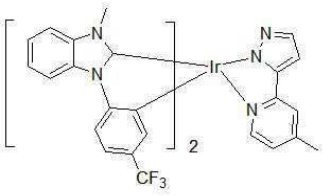


B-71

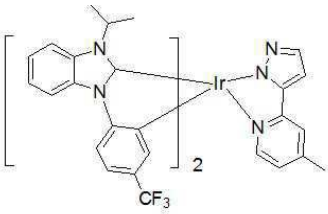


B-72

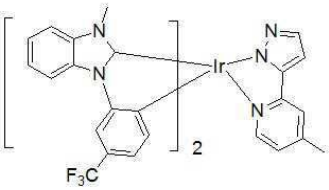
[0071]



B-73

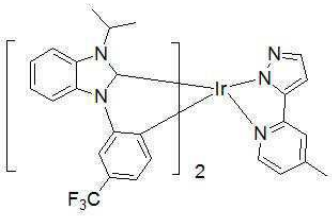


B-74

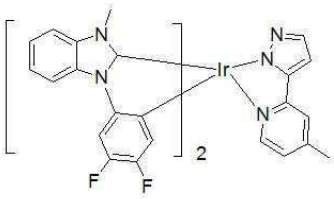


B-75

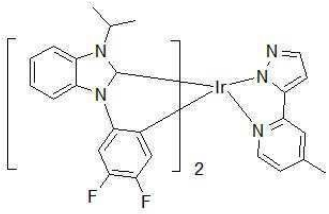
[0072]



B-76

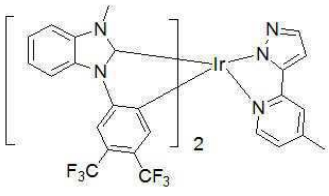


B-77

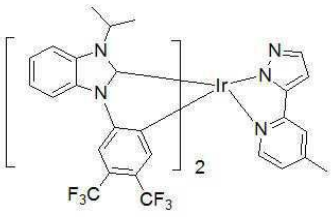


B-78

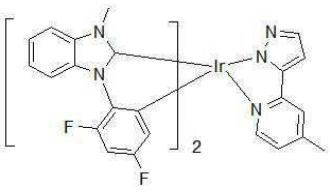
[0073]



B-79

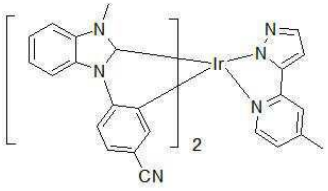


B-80

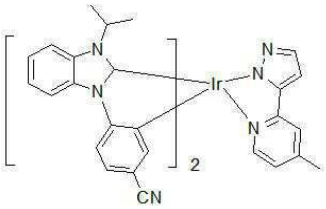


B-81

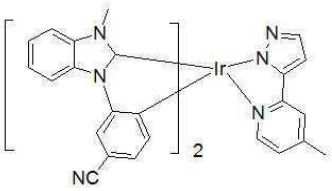
[0074]



B-82

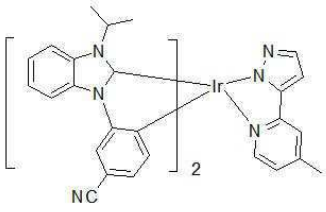


B-83

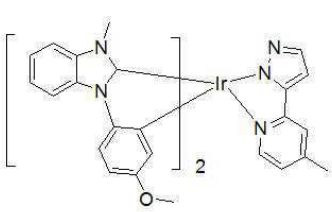


B-84

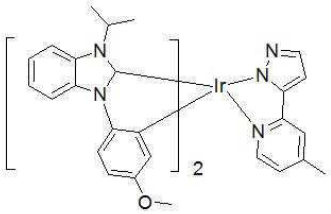
[0075]



B-85

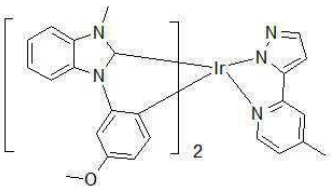


B-86

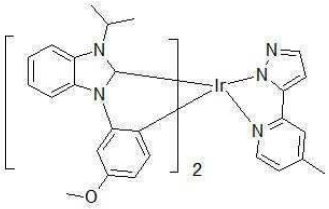


B-87

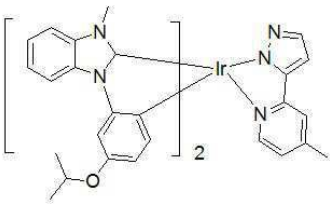
[0076]



B-88

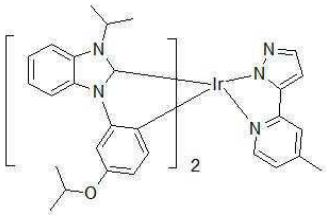


B-89

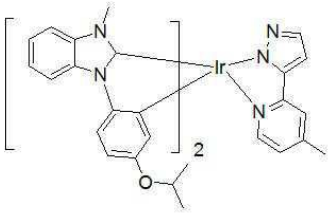


B-90

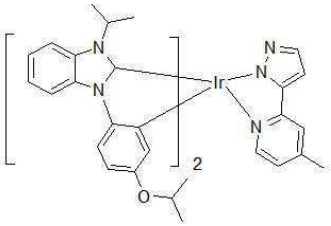
[0077]



B-91

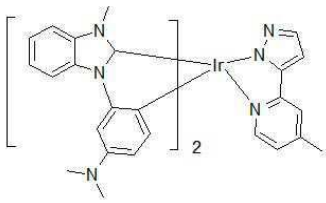


B-92

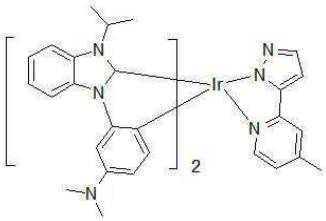


B-93

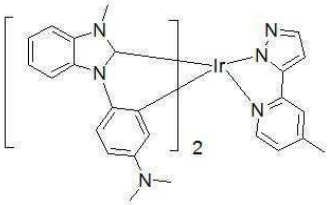
[0078]



B-94

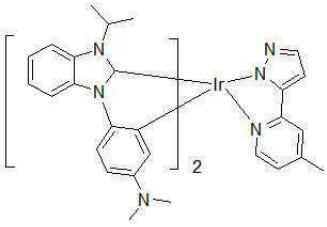


B-95

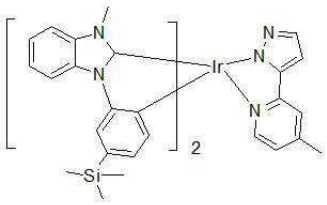


B-96

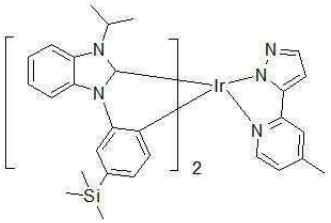
[0079]



B-97

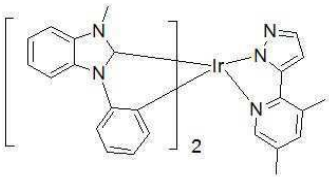


B-98

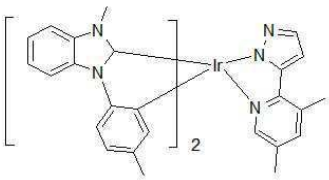


B-99

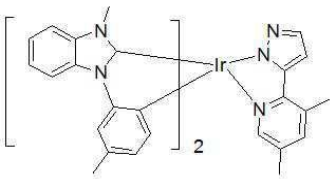
[0080]



B-100

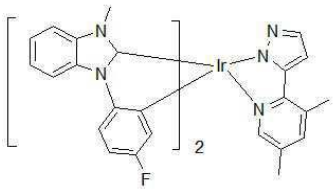


B-101

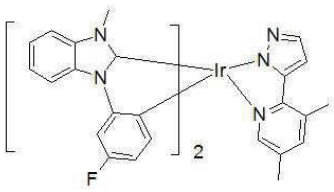


B-102

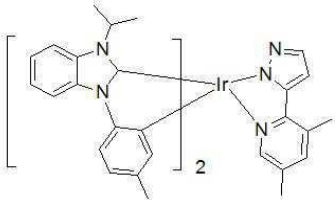
[0081]



B-103

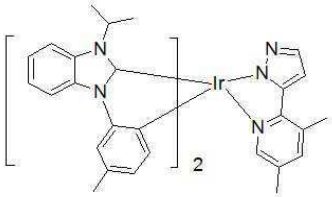


B-104

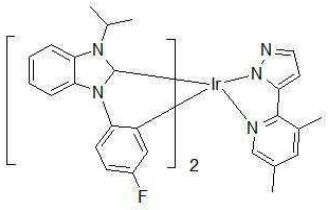


B-105

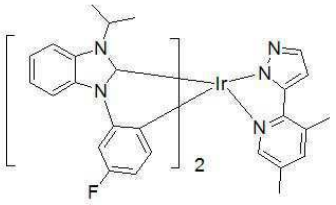
[0082]



B-106

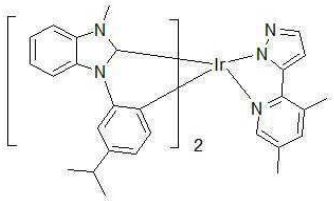


B-107

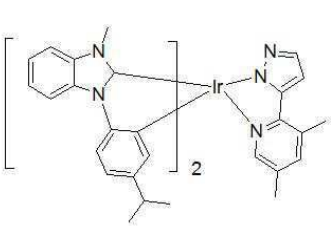


B-108

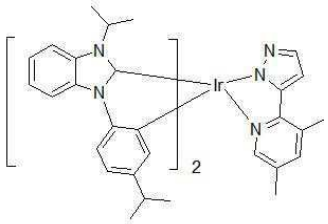
[0083]



B-109

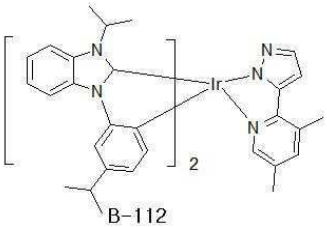


B-110

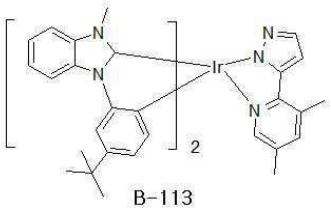


B-111

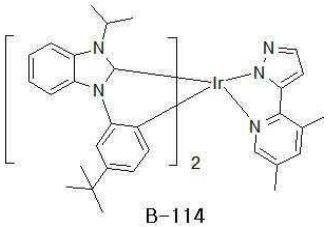
[0084]



B-112

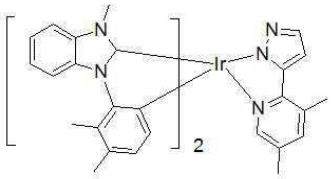


B-113

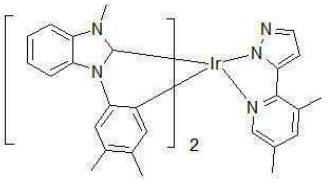


B-114

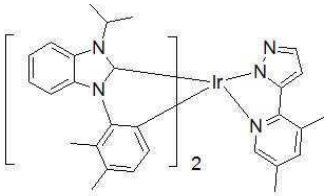
[0085]



B-115

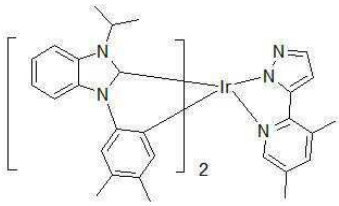


B-116

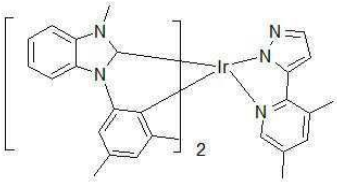


B-117

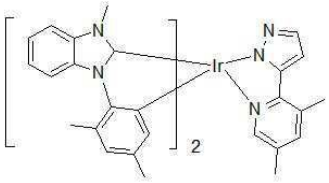
[0086]



B-118

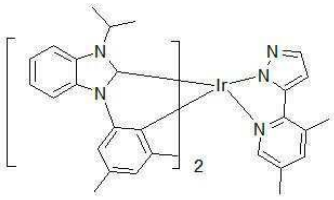


B-119

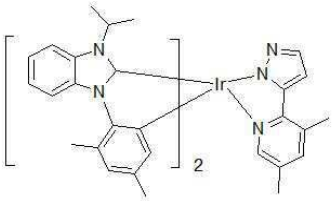


B-120

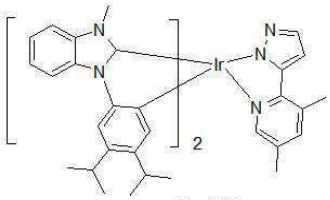
[0087]



B-121

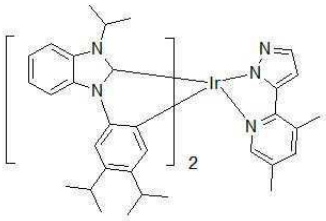


B-122

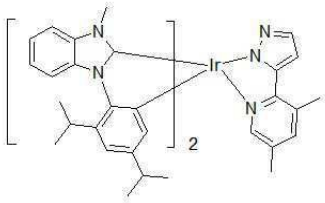


B-123

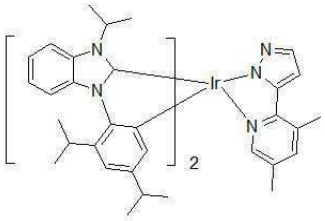
[0088]



B-124

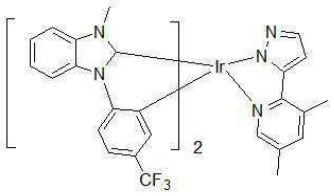


B-125

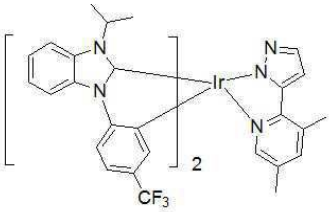


B-126

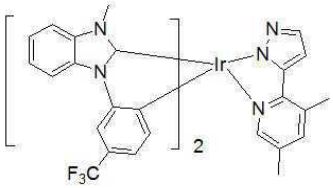
[0089]



B-127

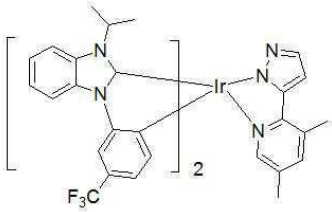


B-128

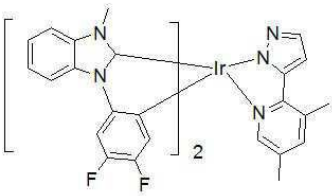


B-129

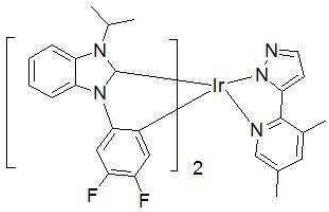
[0090]



B-140

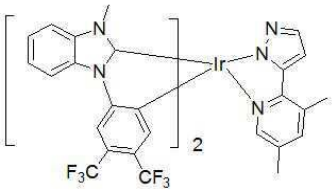


B-141

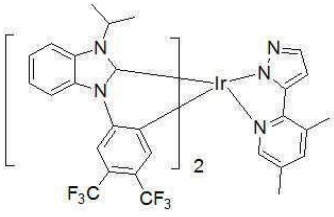


B-142

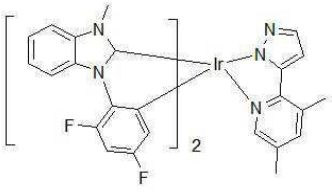
[0091]



B-143

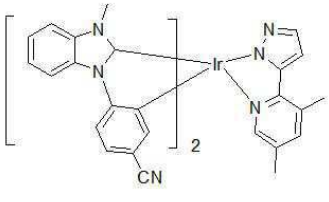


B-144

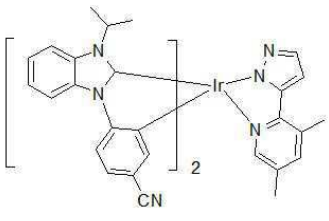


B-145

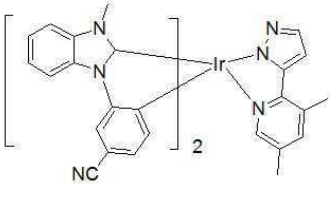
[0092]



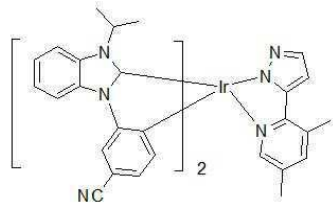
B-146

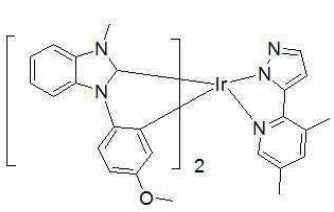


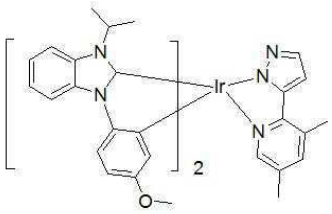
B-147

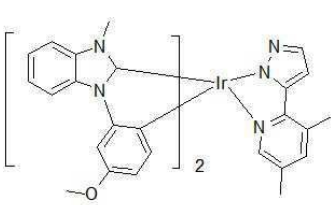


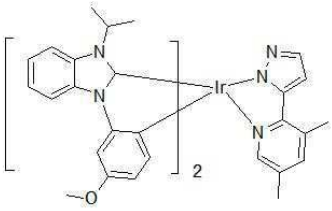
B-148

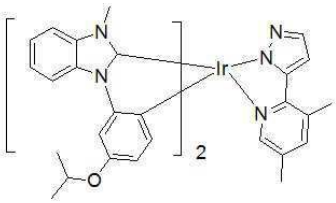
[0093] 
B-149

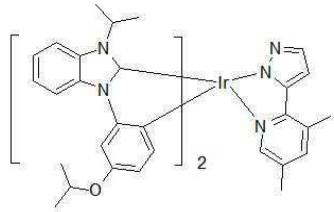

B-150

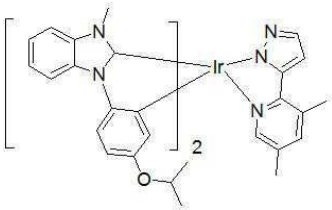

B-151

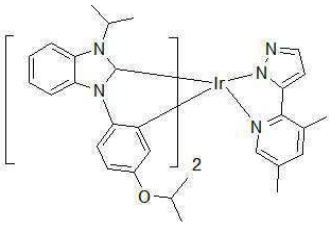
[0094] 
B-152

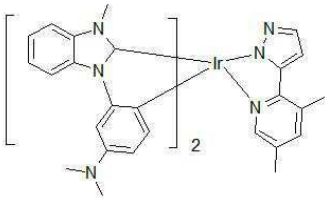

B-153

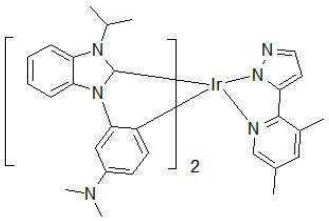

B-154

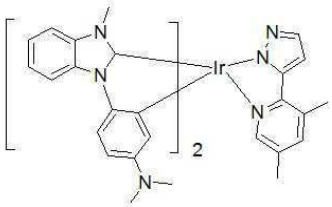
[0095] 
B-155

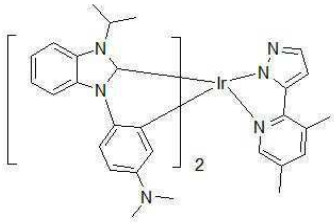

B-156

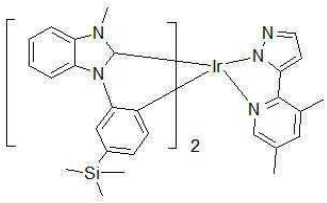

B-157

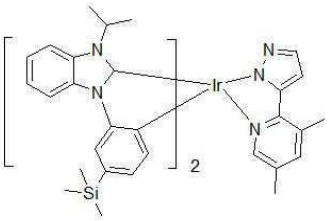
[0096] 
B-158


B-159


B-160

[0097] 
B-161


B-162


B-163

[0098] 또한, 본 발명의 일 실시예에 따른 유기전계발광소자는 양극과 음극 사이에 형성된 유기막을 포함하는 유기전계발광소자에 있어서, 상기 유기막이 상기 청색 인광 화합물을 포함하는 것을 특징으로 한다.

[0099] 상기 유기막이 발광층인 것을 특징으로 한다.

[0100] 상기 청색 인광 화합물이 상기 발광층의 도펀트로 사용되는 것을 특징으로 한다.

[0101] 상기 양극과 상기 음극 사이에 정공주입층, 정공수송층, 전자수송층 및 전자주입층 중 선택된 어느 하나 이상을 더 포함하는 것을 특징으로 한다.

발명의 효과

[0102] 본 발명의 청색 인광 화합물 및 이를 사용한 유기전계발광소자는 삼중항 에너지가 높은 신규 청색 인광 화합물

을 제조하고, 이를 유기전계발광소자의 발광층의 도펀트로 형성함으로써, 발광층에서의 에너지 전이를 용이하게 하여 청색의 발광효율을 향상시킬 수 있는 이점이 있다.

도면의 간단한 설명

[0103] 도 1은 본 발명의 일 실시예에 따른 유기전계발광소자를 나타낸 도면.

도 2는 본 발명의 화합물 1의 UV 흡수 스펙트럼과 상온에서의 PL 스펙트럼을 측정하여 나타낸 그래프.

도 3은 본 발명의 화합물 2의 UV 흡수 스펙트럼과 상온에서의 PL 스펙트럼을 측정하여 나타낸 그래프.

도 4는 본 발명의 화합물 3의 UV 흡수 스펙트럼과 상온에서의 PL 스펙트럼을 측정하여 나타낸 그래프.

발명을 실시하기 위한 구체적인 내용

[0104] 이하, 첨부된 도면을 참조하여 본 발명의 다양한 실시 예들을 자세하게 설명하면 다음과 같다.

[0105] 도 1은 본 발명의 일 실시예에 따른 유기전계발광소자를 나타낸 도면이다.

[0106] 도 1을 참조하면, 본 발명의 일 실시예에 따른 유기전계발광소자(100)는 양극(110), 정공주입층(120), 정공수송층(130), 발광층(140), 전자수송층(150), 전자주입층(160) 및 음극(170)을 포함할 수 있다.

[0107] 상기 양극(110)은 정공을 주입하는 전극으로 일함수가 높은 ITO(Indium Tin Oxide), IZO(Indium Zinc Oxide) 또는 ZnO(Zinc Oxide) 중 어느 하나일 수 있다. 또한, 상기 양극(110)이 반사 전극일 경우에 양극(110)은 ITO, IZO 또는 ZnO 중 어느 하나로 이루어진 층 하부에 알루미늄(Al), 은(Ag) 또는 니켈(Ni) 중 어느 하나로 이루어진 반사층을 더 포함할 수 있다.

[0108] 상기 정공주입층(120)은 양극(110)으로부터 발광층(140)으로 정공의 주입을 원활하게 하는 역할을 할 수 있으며, CuPc(cupper phthalocyanine), PEDOT(poly(3,4)-ethylenedioxythiophene), PANI(polyaniline) 및 NPD(N,N-dinaphthyl-N,N'-diphenyl benzidine)로 이루어진 군에서 선택된 어느 하나 이상으로 이루어질 수 있으나 이에 한정되지 않는다.

[0109] 상기 정공주입층(120)의 두께는 1 내지 150nm일 수 있다. 여기서, 상기 정공주입층(120)의 두께가 1nm 이상이면, 정공 주입 특성이 저하되는 것을 방지할 수 있는 이점이 있고, 150nm 이하이면, 정공주입층(120)의 두께가 너무 두꺼워 정공의 이동을 향상시키기 위해 구동전압이 상승되는 것을 방지할 수 있는 이점이 있다.

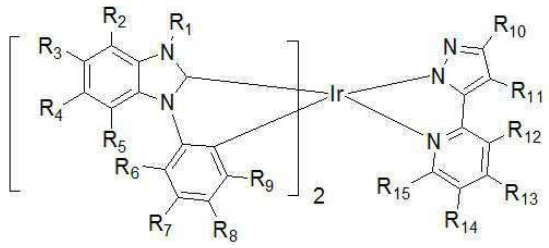
[0110] 상기 정공수송층(130)은 정공의 수송을 원활하게 하는 역할을 하며, NPD(N,N-dinaphthyl-N,N'-diphenyl benzidine), TPD(N,N'-bis-(3-methylphenyl)-N,N'-bis-(phenyl)-benzidine), s-TAD 및 MTDATA(4,4',4"-Tris(N-3-methylphenyl-N-phenyl-amino)-triphenylamine)로 이루어진 군에서 선택된 어느 하나 이상으로 이루어질 수 있으나 이에 한정되지 않는다.

[0111] 상기 정공수송층(130)의 두께는 1 내지 150nm일 수 있다. 여기서, 상기 정공수송층(130)의 두께가 5nm 이상이면, 정공 수송 특성이 저하되는 것을 방지할 수 있는 이점이 있고, 150nm 이하이면, 정공수송층(130)의 두께가 너무 두꺼워 정공의 이동을 향상시키기 위해 구동전압이 상승되는 것을 방지할 수 있는 이점이 있다.

[0112] 상기 발광층(140)은 적색, 녹색 및 청색을 발광하는 물질로 이루어질 수 있으며, 인광 또는 형광물질을 이용하여 형성할 수 있다. 본 실시 예에서는 청색을 발광하는 인광 물질에 대해 설명한다.

[0113] 본 발명의 발광층(140)은 호스트(host)와 도펀트(dopant)로 이루어진다. 보다 자세하게, 본 발명의 도펀트는 하기 화학식 1로 표시되는 청색 인광 화합물로 이루어진다.

[0114] [화학식 1]

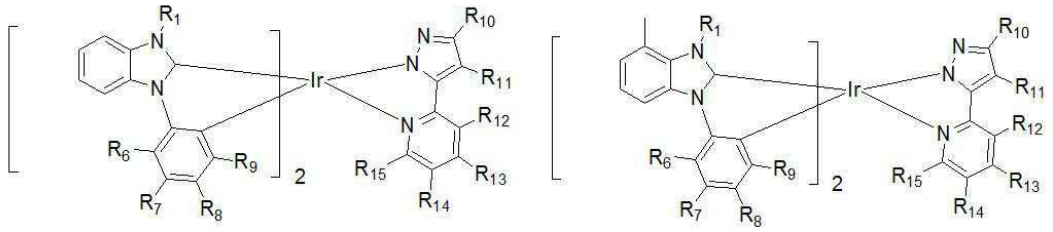


[0115]

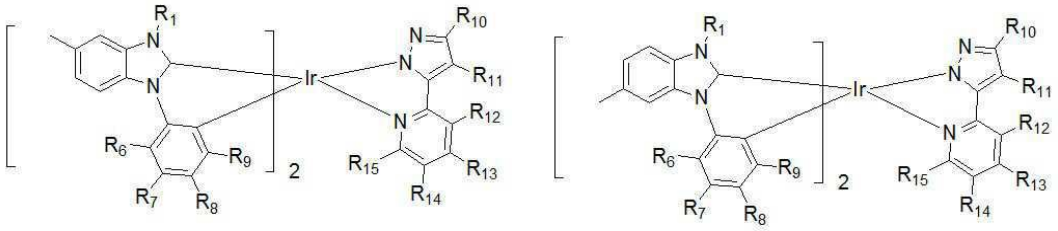
[0116] 상기 화학식 1에서, R_1 내지 R_{15}는 각각 독립적으로 수소, 중수소. F, Cl, Br의 할로겐, C1 내지 C20의 알킬기, C1 내지 C20의 알콕시기, C1 내지 C20의 사이클로 알킬기, C6 내지 C20의 치환 또는 비치환된 방향족 그룹, C5 내지 C20의 치환 또는 비치환된 이형고리 그룹, 시아노기, 트리플루오로메틸기, C1 내지 C20의 아민기, C6내지 C20의 방향족 그룹이 치환된 아민기, C5 내지 C20의 이형고리 그룹이 치환된 아민기 및 C1 내지 C20의 실릴기로 부터 이루어진 군에서 선택된 어느 하나일 수 있다.

[0117] 상기 청색 인광 화합물은 하기 표시되는 화합물들 중 선택된 어느 하나일 수 있다.

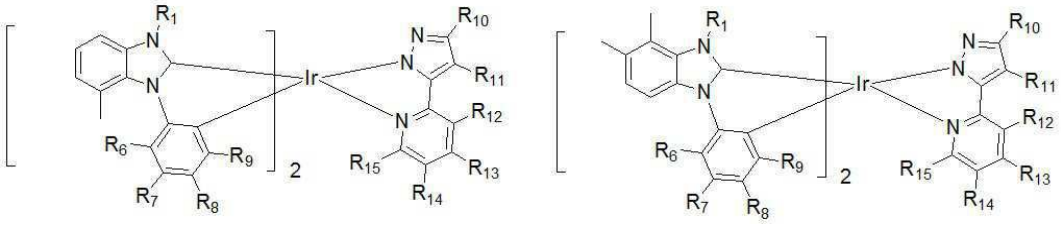
[0118]



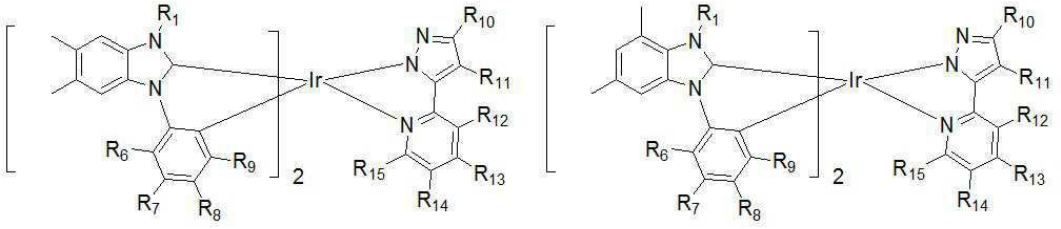
[0119]



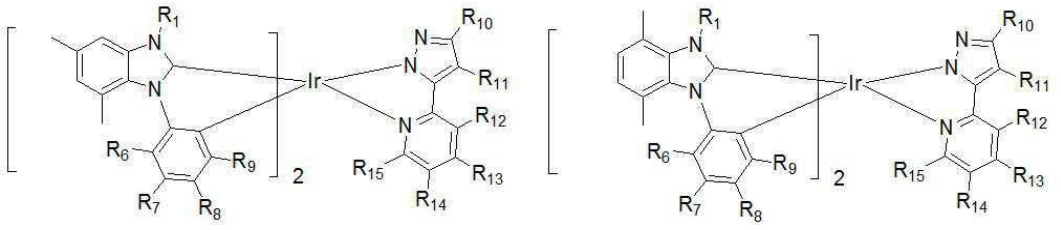
[0120]

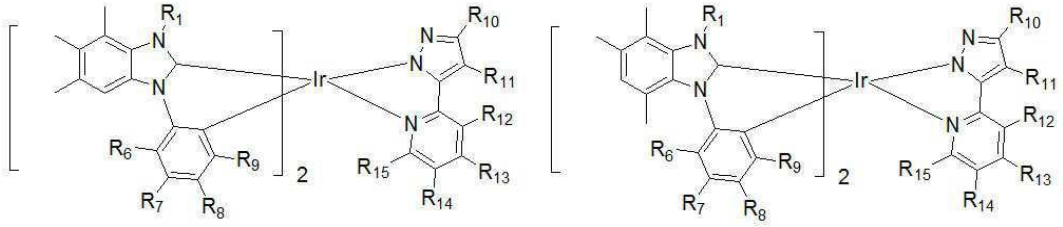


[0121]

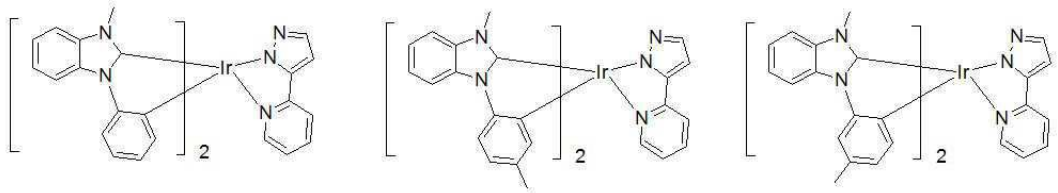


[0122]

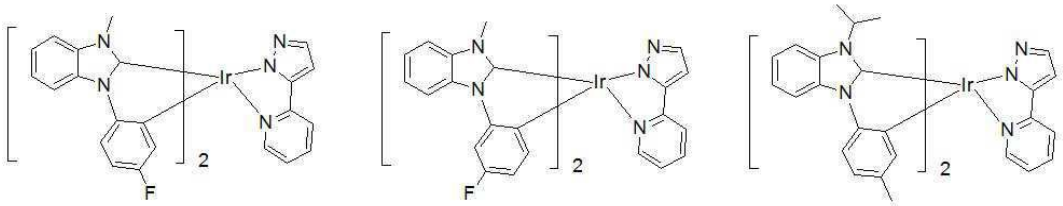


[0123] 

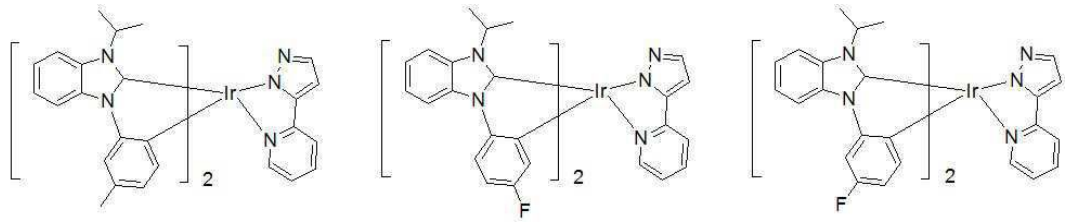
[0124] 상기 청색 인광 화합물은 하기 표시되는 화합물들 중 선택된 어느 하나일 수 있다.

[0125] 

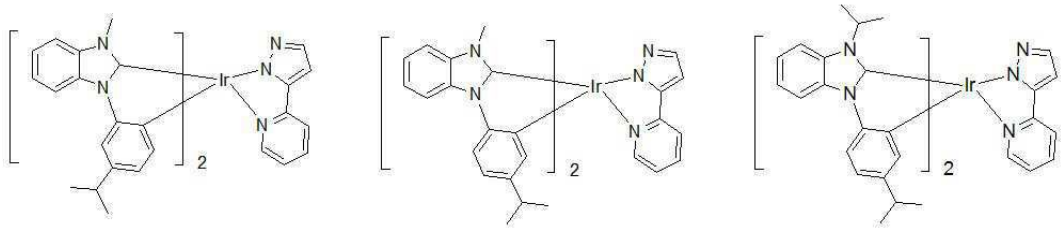
A-1 A-2 A-3

[0126] 

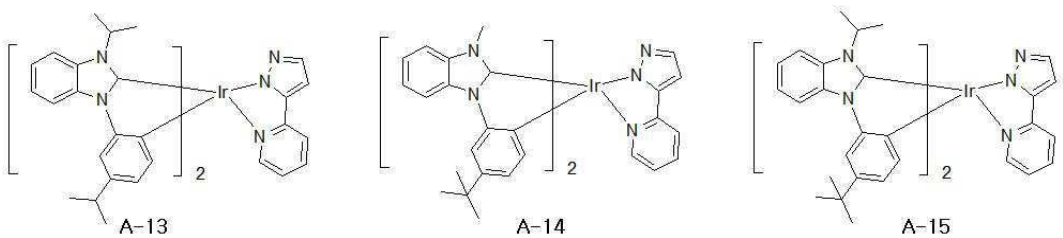
A-4 A-5 A-6

[0127] 

A-7 A-8 A-9

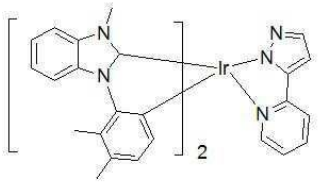
[0128] 

A-10 A-11 A-12

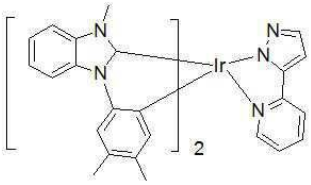
[0129] 

A-13 A-14 A-15

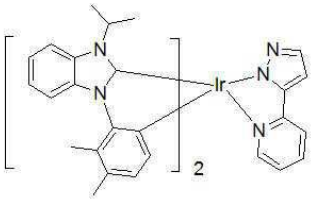
[0130]



A-16

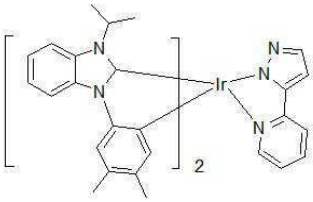


A-17

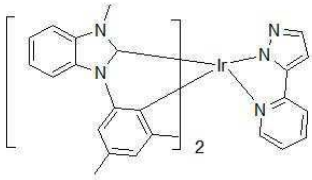


A-18

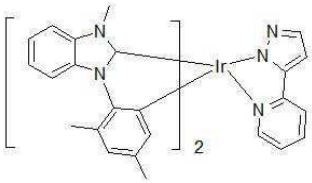
[0131]



A-19

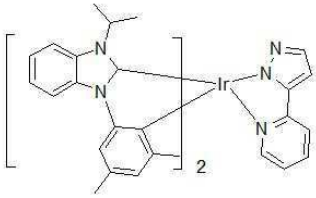


A-20

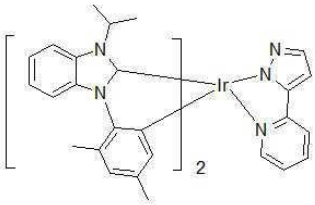


A-21

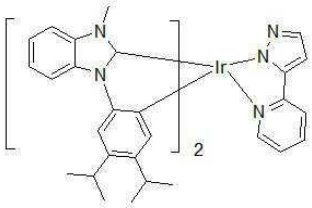
[0132]



A-22

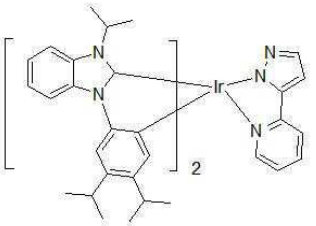


A-23

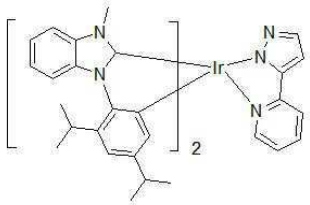


A-24

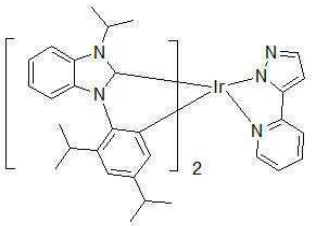
[0133]



A-25

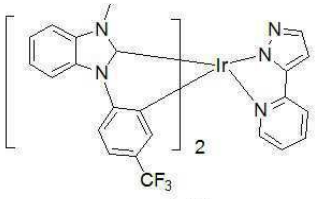


A-26

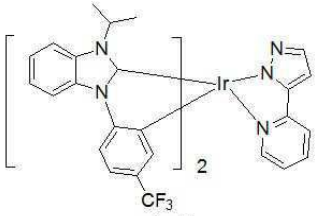


A-27

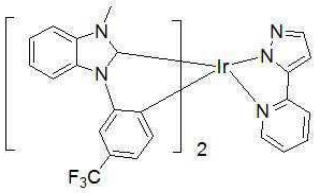
[0134]



A-28

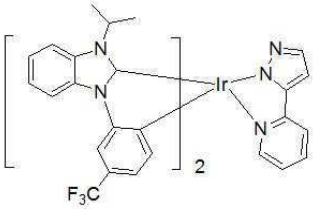


A-29

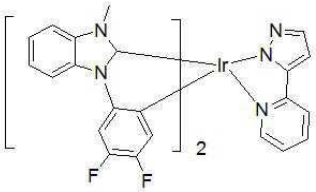


A-30

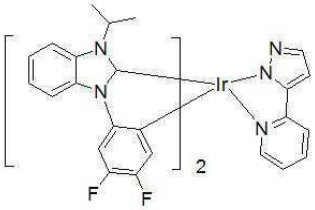
[0135]



A-31

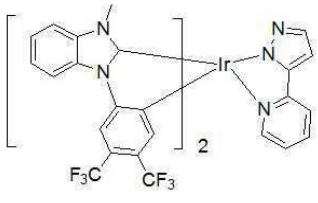


A-32

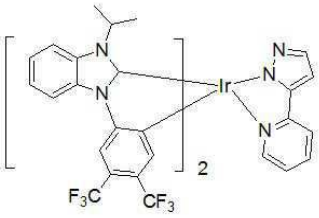


A-33

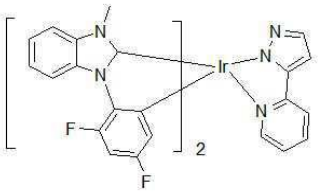
[0136]



A-34

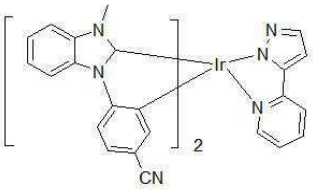


A-35

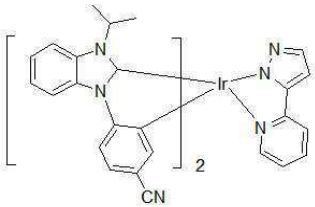


A-36

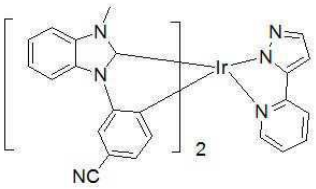
[0137]



A-37

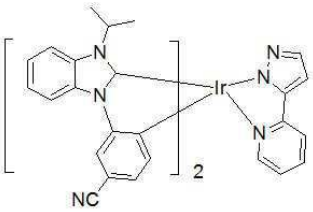


A-38

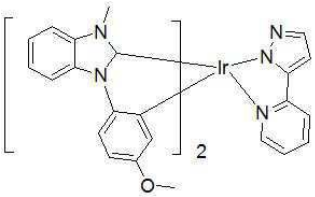


A-39

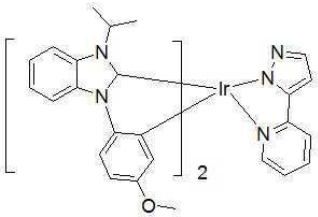
[0138]



A-40

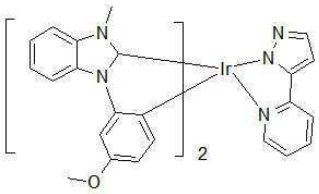


A-41

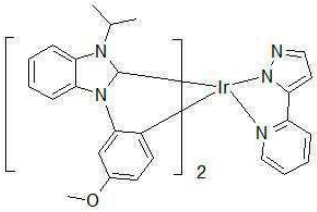


A-42

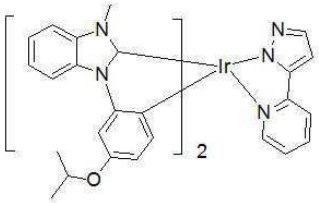
[0139]



A-43

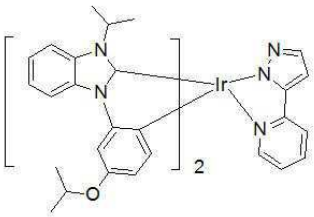


A-44

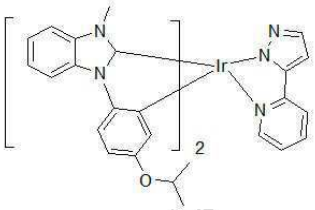


A-45

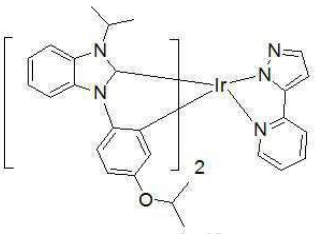
[0140]



A-46

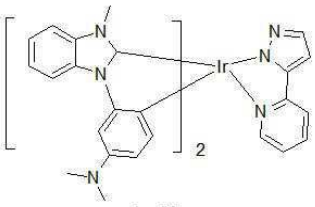


A-47

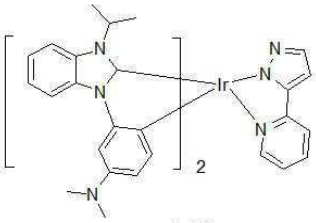


A-48

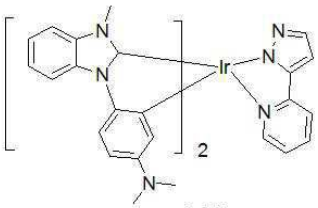
[0141]



A-49

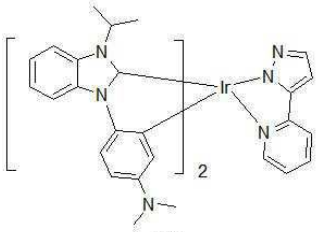


A-50

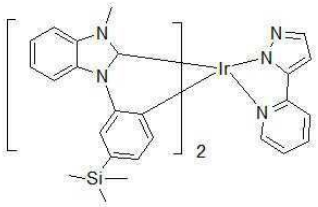


A-51

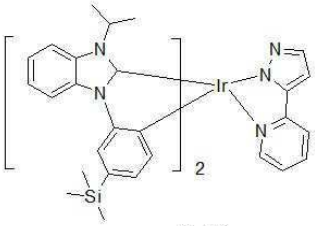
[0142]



A-52

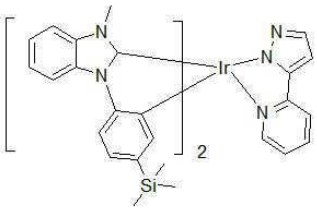


A-53

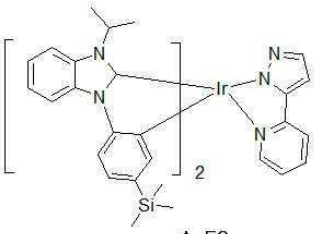


A-54

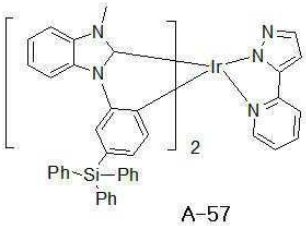
[0143]



A-55

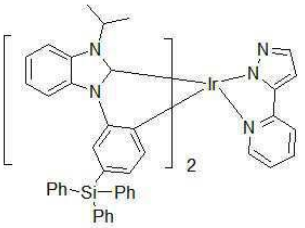


A-56

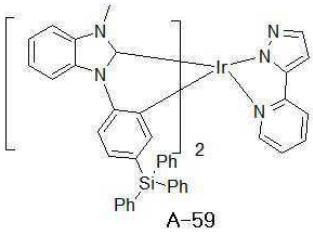


A-57

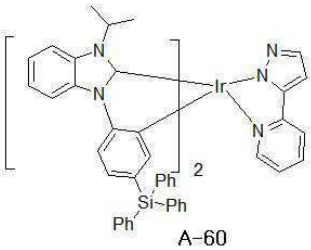
[0144]



A-58

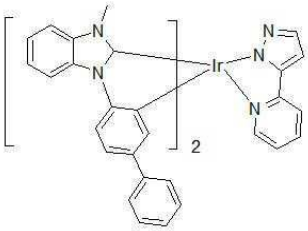


A-59

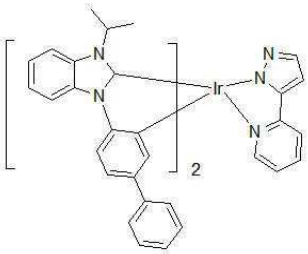


A-60

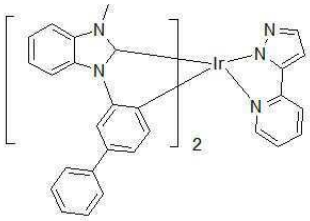
[0145]



A-61

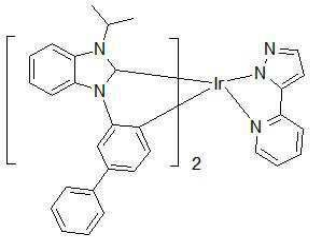


A-62

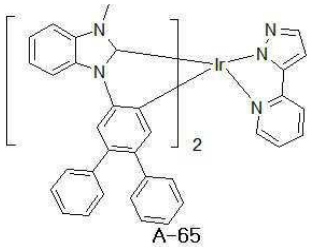


A-63

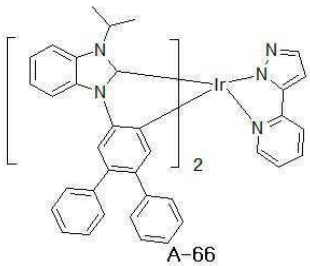
[0146]



A-64

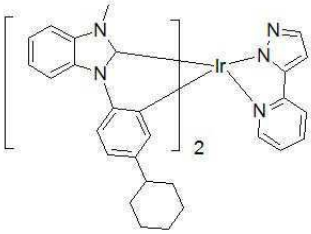


A-65

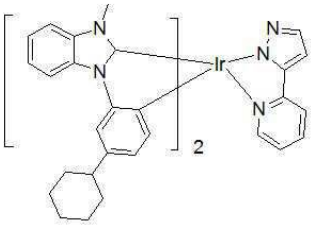


A-66

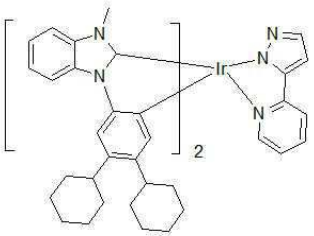
[0147]



A-67

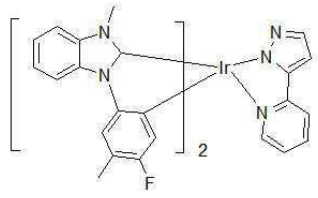


A-68

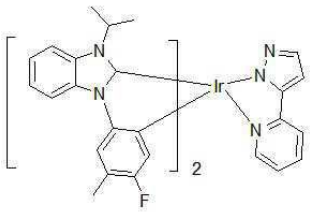


A-69

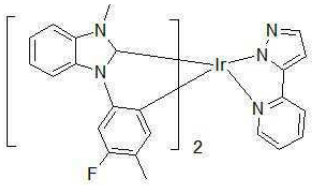
[0148]



A-70

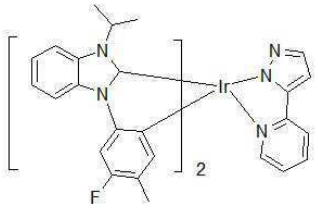


A-71

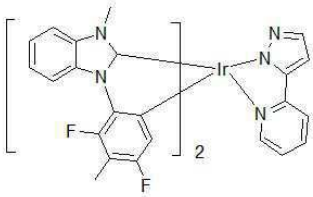


A-72

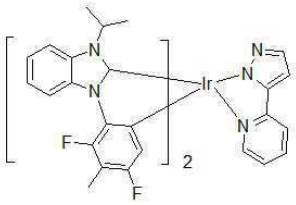
[0149]



A-73

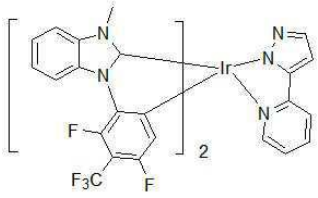


A-74

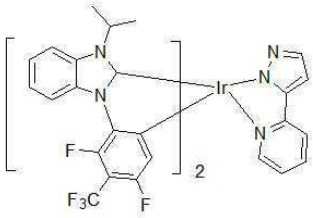


A-75

[0150]

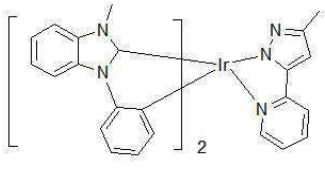


A-76

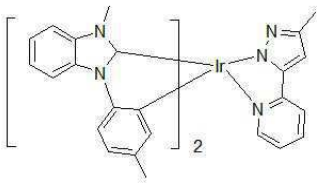


A-77

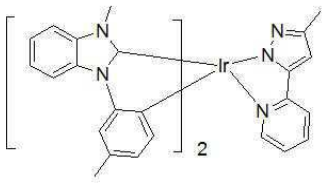
[0151]



B-1

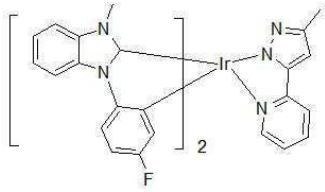


B-2

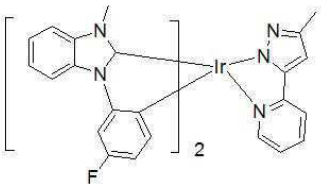


B-3

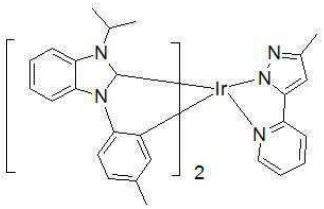
[0152]



B-4

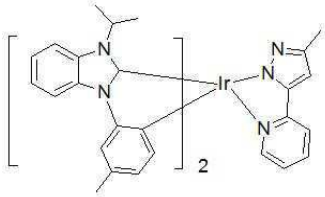


B-5

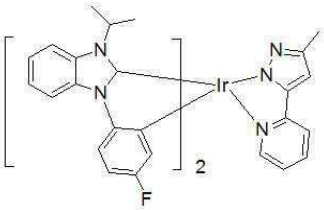


B-6

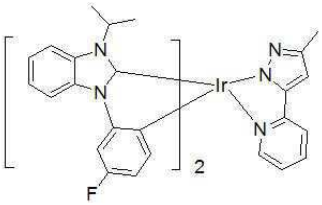
[0153]



B-7

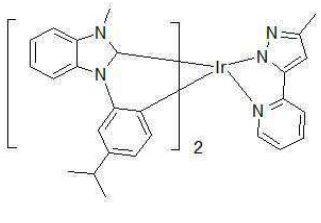


B-8

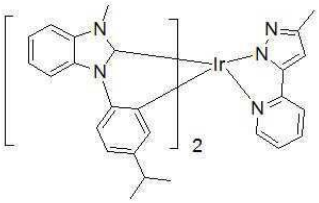


B-9

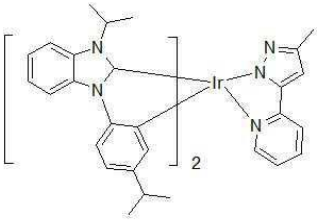
[0154]



B-10

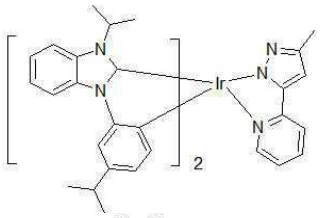


B-11

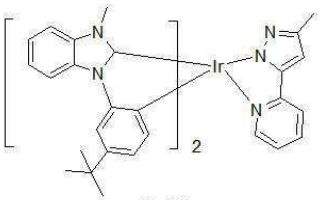


B-12

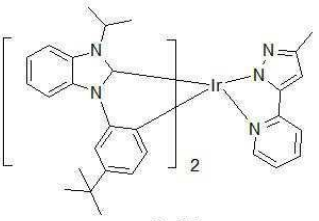
[0155]



B-13

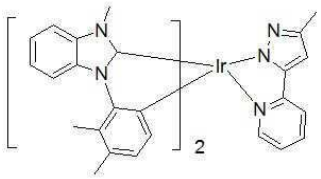


B-14

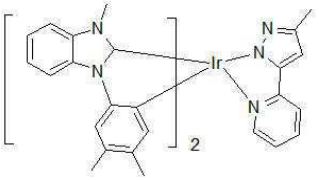


B-15

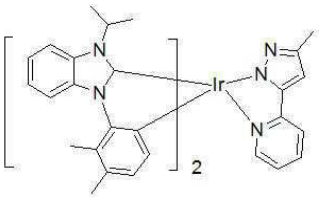
[0156]



B-16

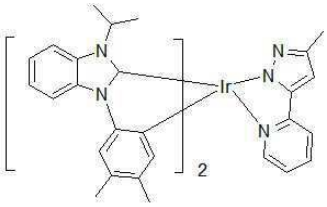


B-17

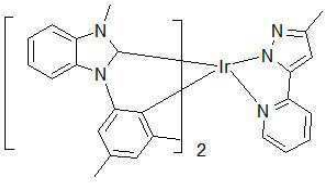


B-18

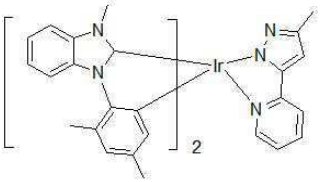
[0157]



B-19

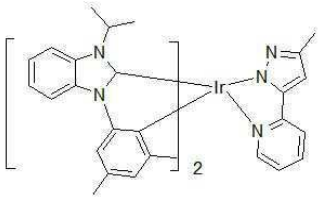


B-20

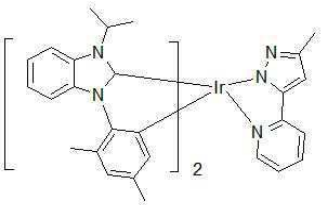


B-21

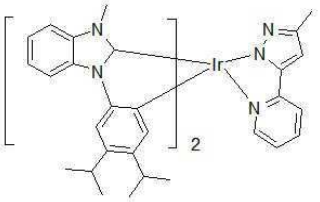
[0158]



B-22

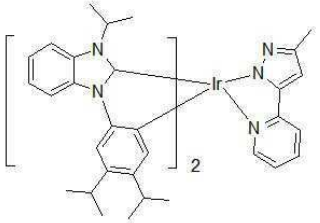


B-23

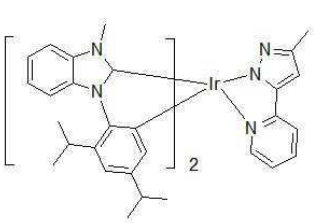


B-24

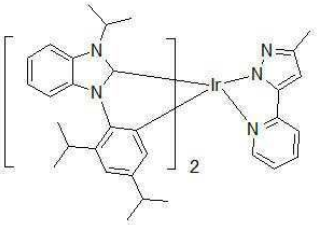
[0159]



B-25

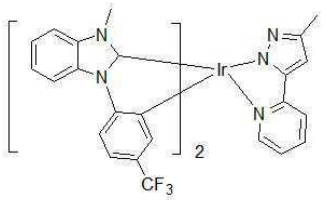


B-26

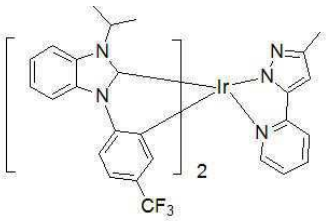


B-27

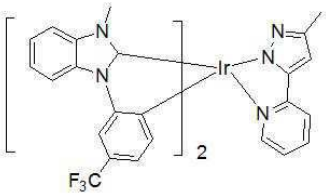
[0160]



B-28

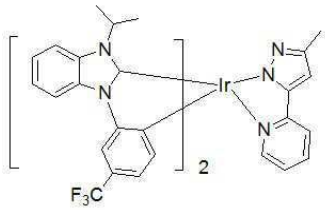


B-29

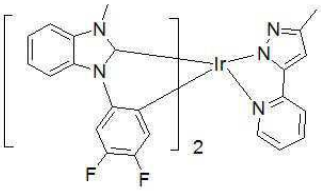


B-30

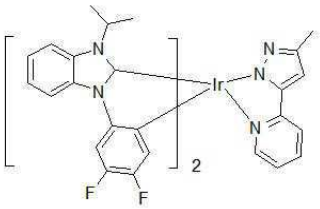
[0161]



B-31

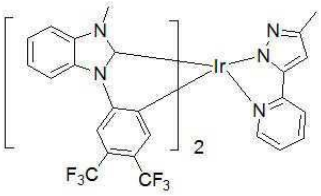


B-32

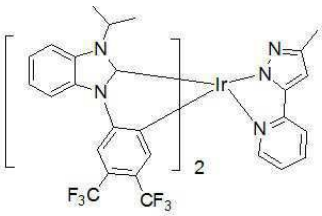


B-33

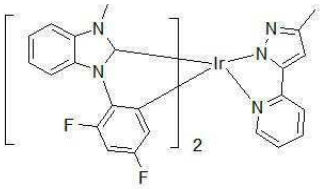
[0162]



B-34

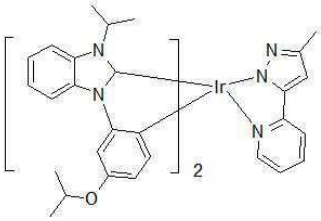


B-35

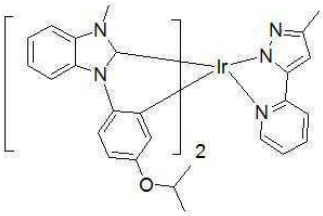


B-36

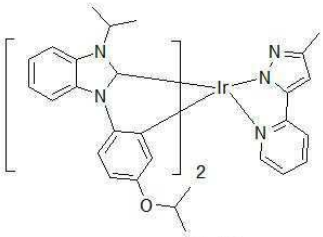
[0163]



B-37

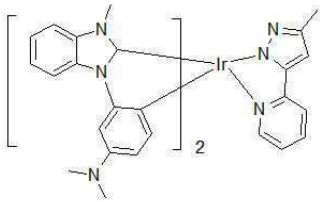


B-38

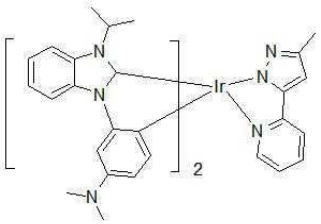


B-39

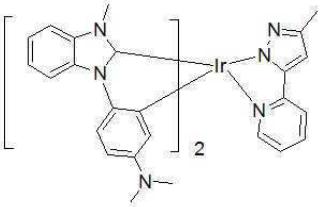
[0164]



B-40

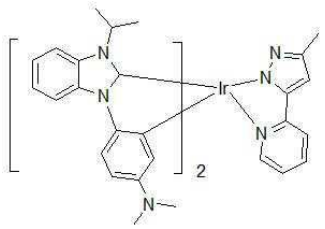


B-41

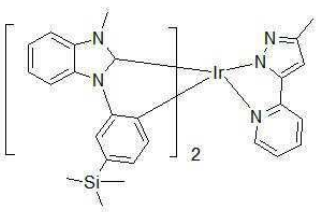


B-42

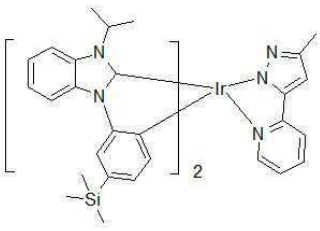
[0165]



B-43

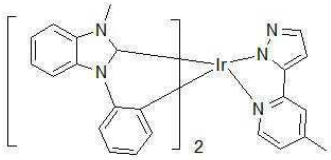


B-44

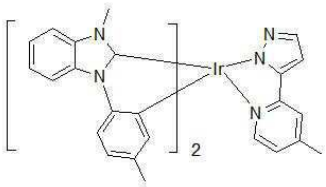


B-45

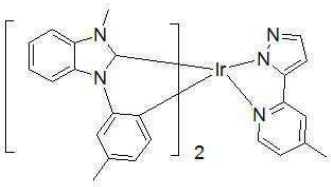
[0166]



B-46

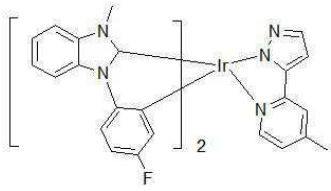


B-47

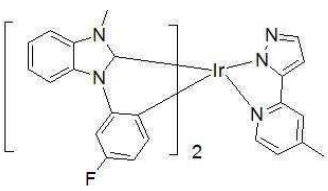


B-48

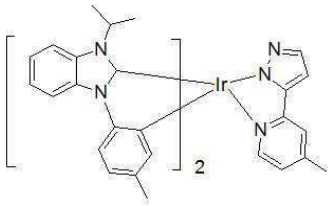
[0167]



B-49

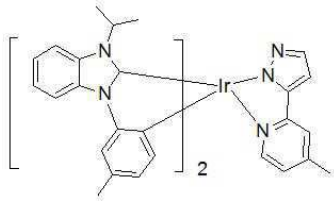


B-50

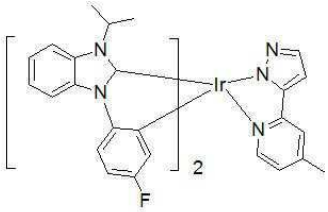


B-51

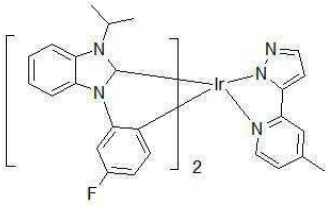
[0168]



B-52

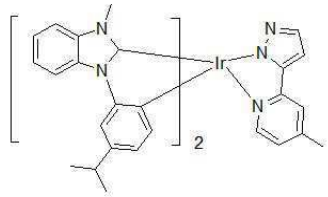


B-53

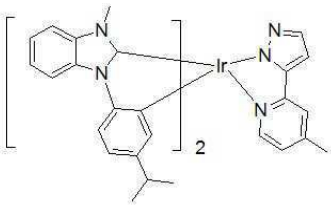


B-54

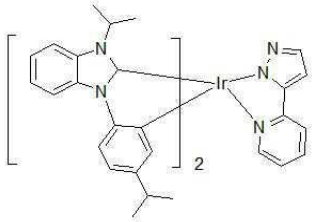
[0169]



B-55

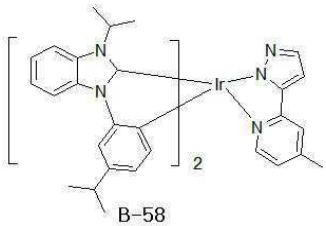


B-56

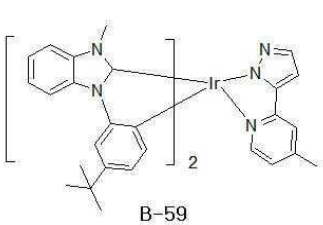


B-57

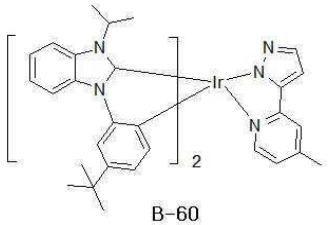
[0170]



B-58

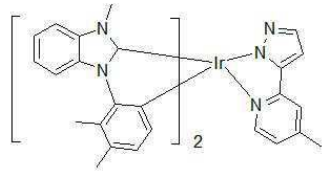


B-59

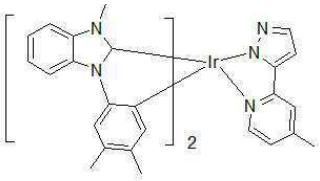


B-60

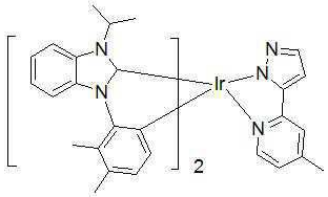
[0171]



B-61

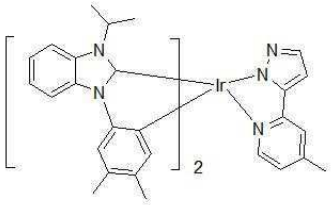


B-62

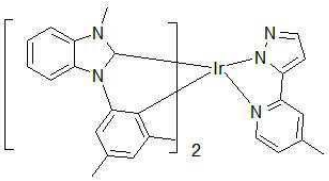


B-63

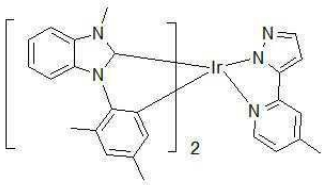
[0172]



B-64

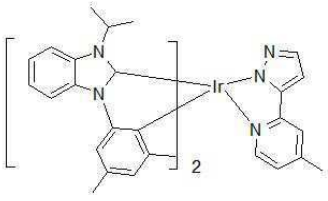


B-65

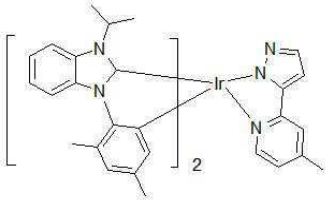


B-66

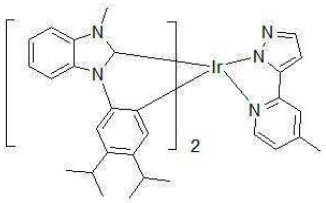
[0173]



B-67

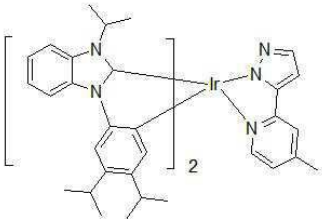


B-68

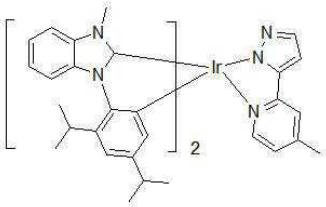


B-69

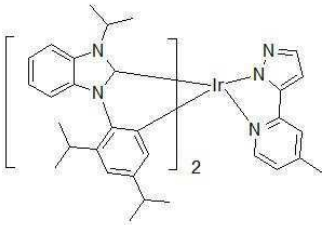
[0174]



B-70

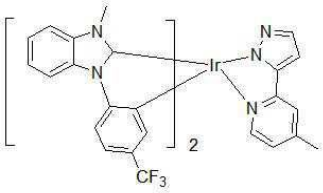


B-71

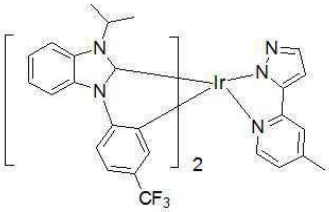


B-72

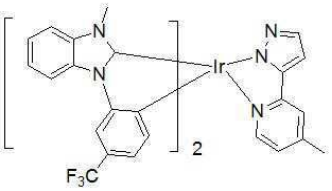
[0175]



B-73

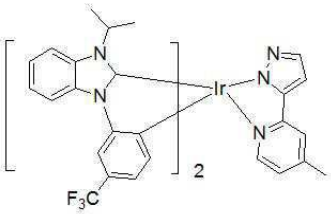


B-74

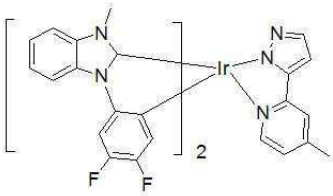


B-75

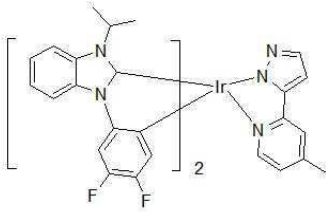
[0176]



B-76

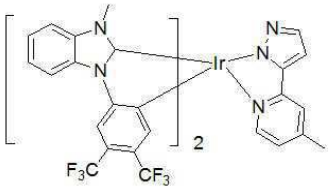


B-77

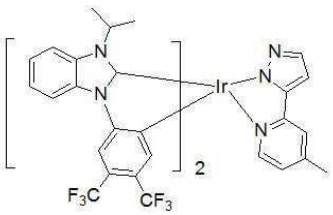


B-78

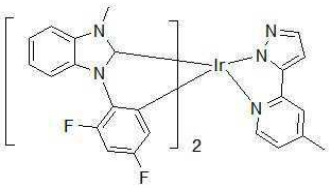
[0177]



B-79

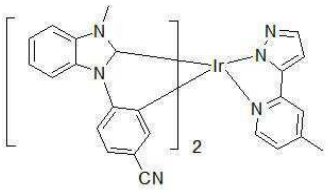


B-80

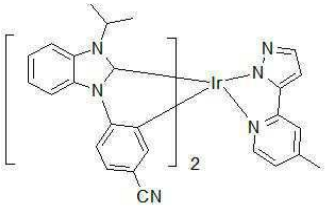


B-81

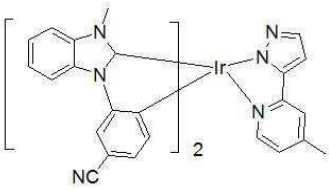
[0178]



B-82

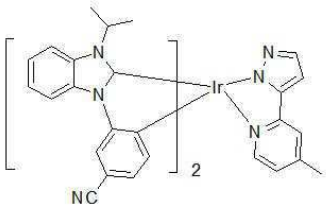


B-83

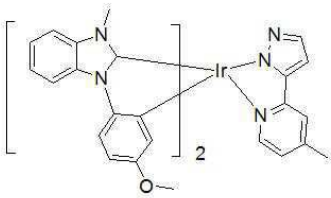


B-84

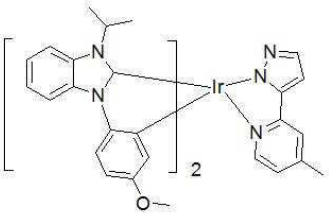
[0179]



B-85

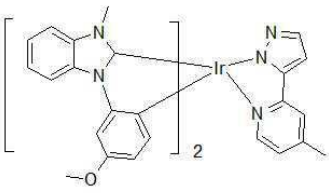


B-86

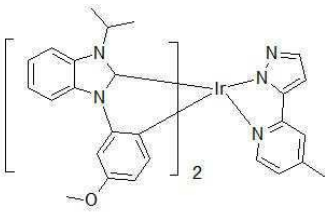


B-87

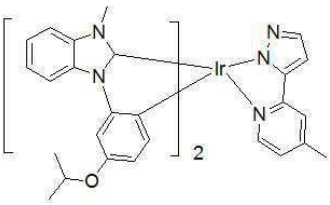
[0180]



B-88

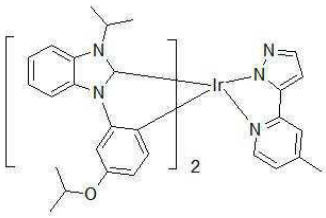


B-89

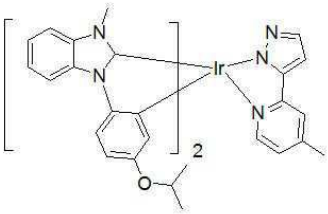


B-90

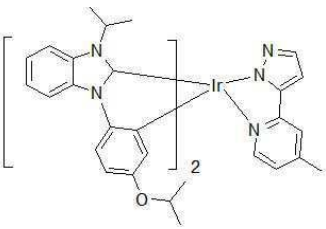
[0181]



B-91

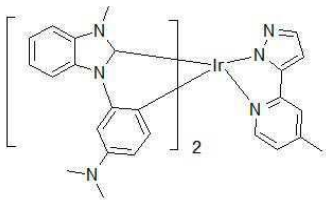


B-92

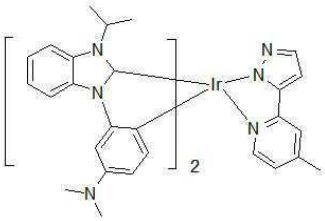


B-93

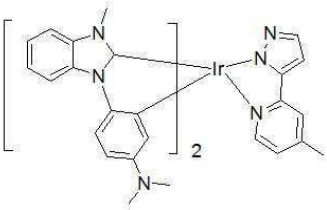
[0182]



B-94

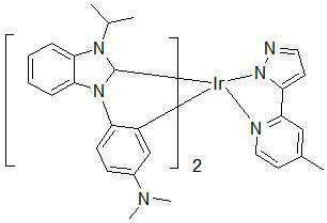


B-95

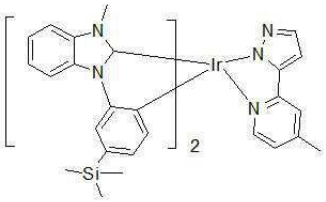


B-96

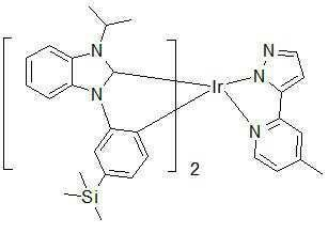
[0183]



B-97

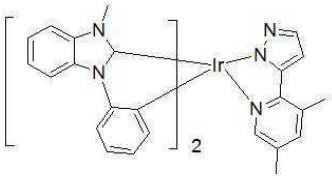


B-98

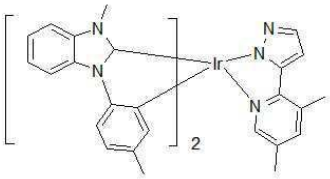


B-99

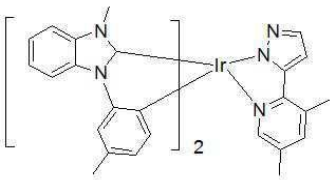
[0184]



B-100

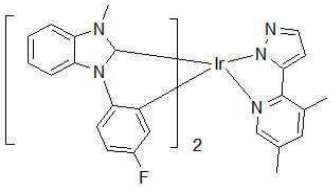


B-101

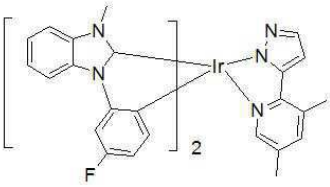


B-102

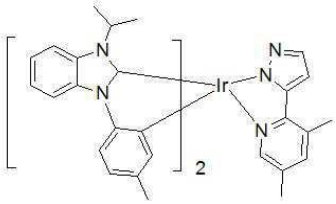
[0185]



B-103

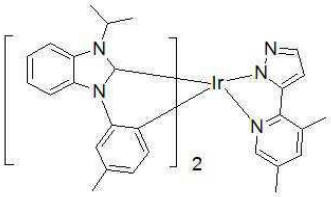


B-104

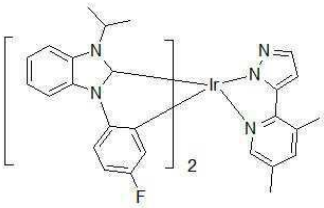


B-105

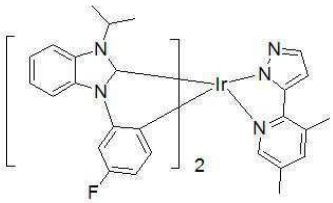
[0186]



B-106

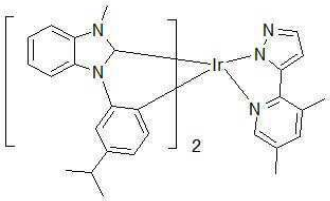


B-107

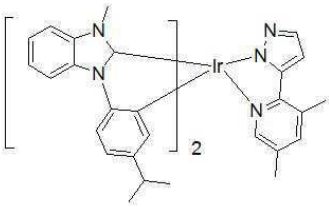


B-108

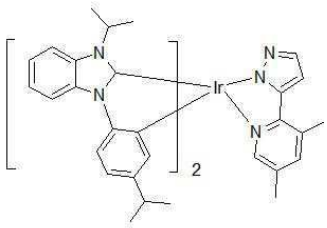
[0187]



B-109

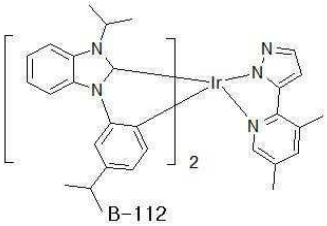


B-110

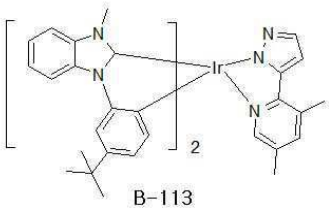


B-111

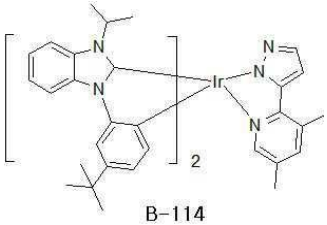
[0188]



B-112

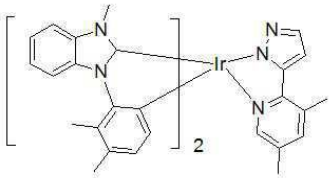


B-113

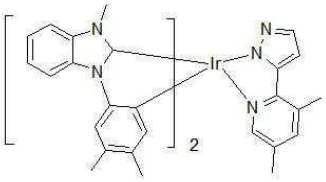


B-114

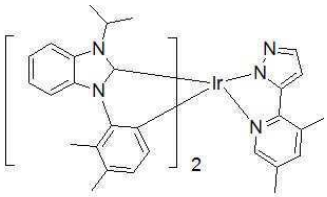
[0189]



B-115

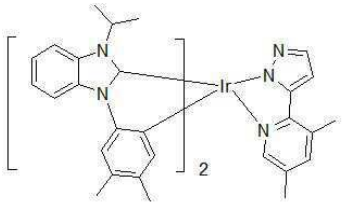


B-116

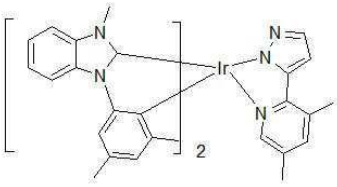


B-117

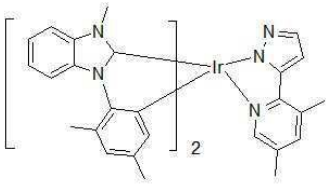
[0190]



B-118

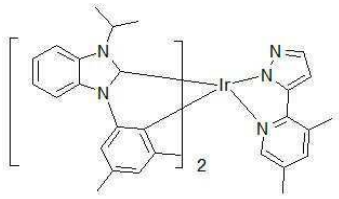


B-119

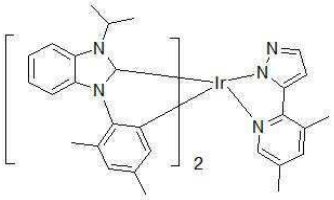


B-120

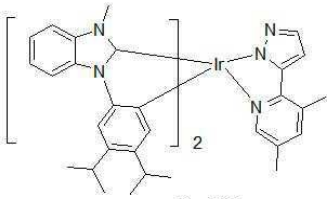
[0191]



B-121

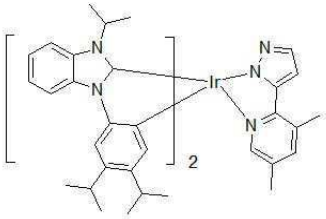


B-122

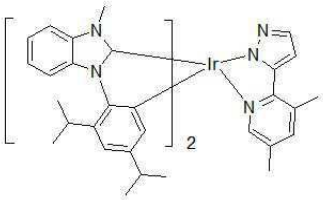


B-123

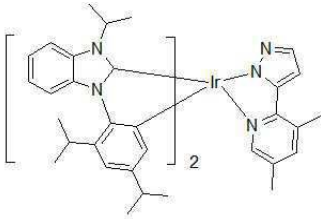
[0192]



B-124

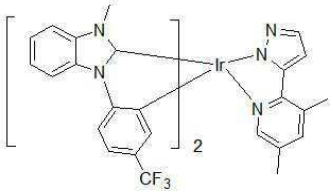


B-125

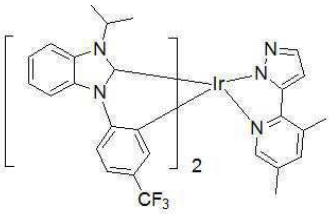


B-126

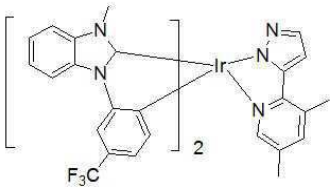
[0193]



B-127

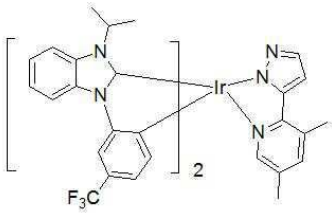


B-128

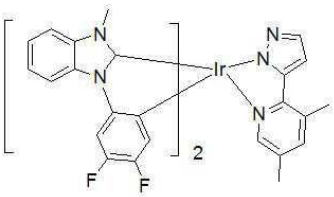


B-129

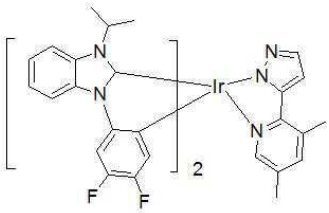
[0194]



B-140

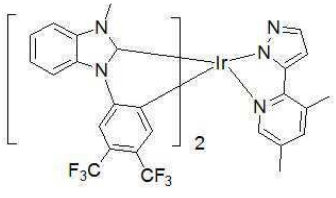


B-141

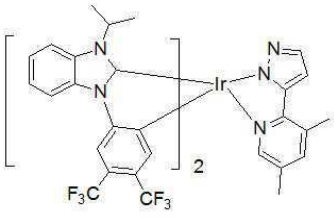


B-142

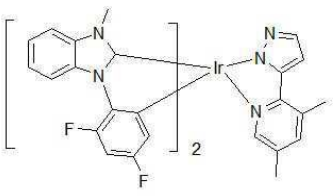
[0195]



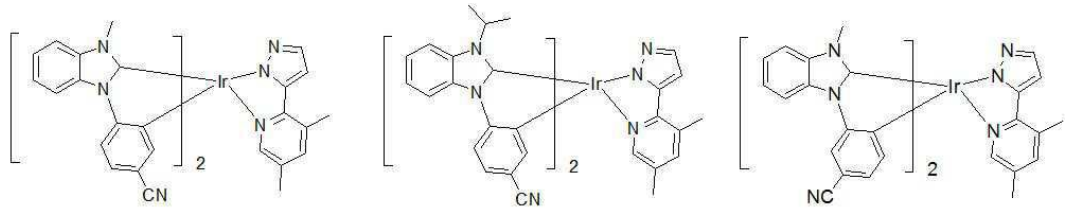
B-143



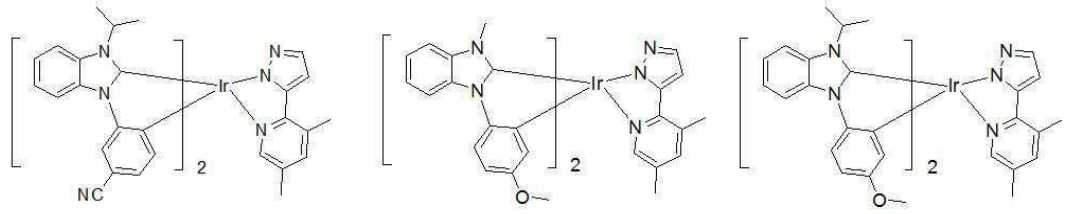
B-144



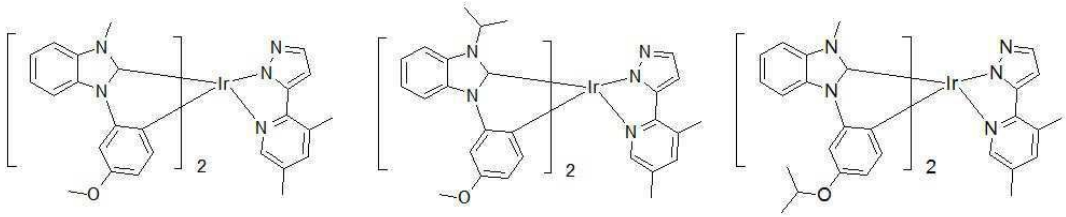
B-145

[0196] 

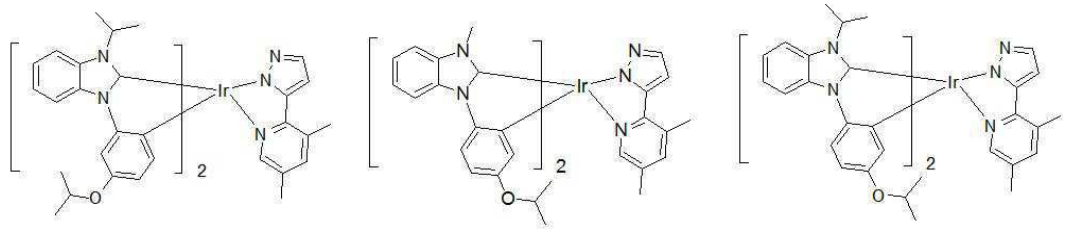
B-146 B-147 B-148

[0197] 

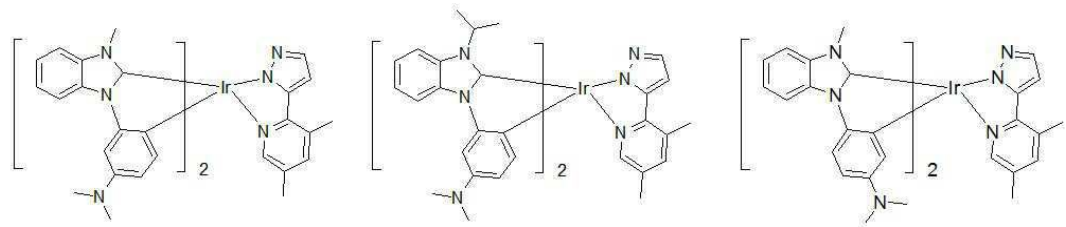
B-149 B-150 B-151

[0198] 

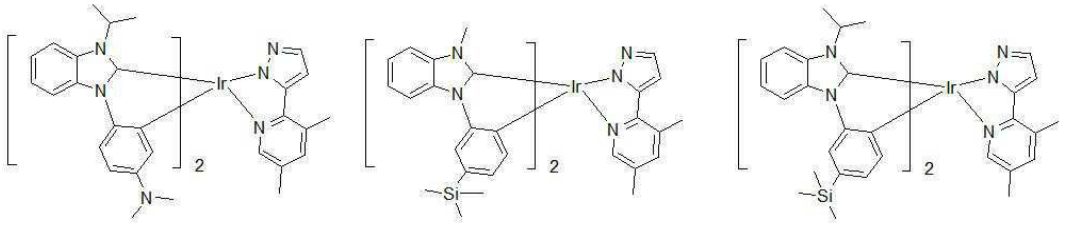
B-152 B-153 B-154

[0199] 

B-155 B-156 B-157

[0200] 

B-158 B-159 B-160

[0201] 

B-161 B-162 B-163

[0202] 발광층(140)은 호스트 100 중량%에 대해 도펀트가 0.1 내지 50 중량%으로 포함될 수 있다.

[0203] 상기 전자수송층(150)은 전자의 수송을 원활하게 하는 역할을 하며, Alq3(tris(8-hydroxyquinolino)aluminum), PBD, TAZ, spiro-PBD, BAlq 및 SAlq로 이루어진 군에서 선택된 어느 하나 이상으로 이루어질 수 있으나 이에 한정되지 않는다.

[0204] 상기 전자수송층(150)의 두께는 1 내지 50nm일 수 있다. 여기서, 상기 전자수송층(150)의 두께가 1nm 이상이면, 전자 수송 특성이 저하되는 것을 방지할 수 있는 이점이 있고, 50nm 이하이면, 전자수송층(150)의 두께가 너무 두꺼워 전자의 이동을 향상시키기 위해 구동전압이 상승되는 것을 방지할 수 있는 이점이 있다.

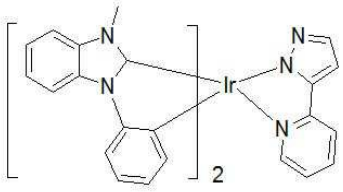
[0205] 상기 전자주입층(160)은 전자의 주입을 원활하게 하는 역할을 하며, Alq3(tris(8-hydroxyquinolino)aluminum), PBD, TAZ, spiro-PBD, BAlq 또는 SAlq를 사용할 수 있으나 이에 한정되지 않는다.

[0206] 상기 전자주입층(160)의 두께는 1 내지 50nm일 수 있다. 여기서, 상기 전자주입층(160)의 두께가 1nm 이상이면, 전자 주입 특성이 저하되는 것을 방지할 수 있는 이점이 있고, 50nm 이하이면, 전자주입층(160)의 두께가 너무 두꺼워 전자의 이동을 향상시키기 위해 구동전압이 상승되는 것을 방지할 수 있는 이점이 있다.

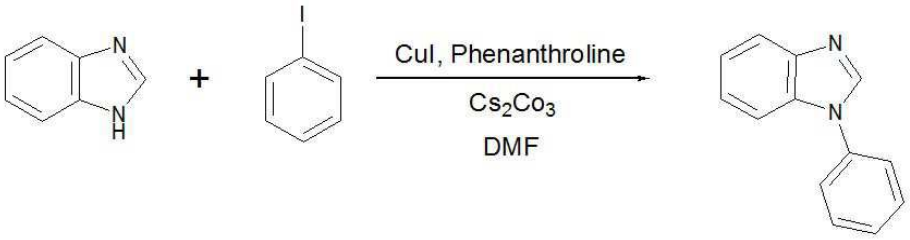
[0207] 상기 음극(170)은 전자 주입 전극으로, 일함수가 낮은 마그네슘(Mg), 칼슘(Ca), 알루미늄(Al), 은(Ag) 또는 이들의 합금으로 이루어질 수 있다. 여기서, 음극(170)은 유기전계발광소자가 전면 또는 양면발광구조일 경우, 빛을 투과할 수 있을 정도로 얇은 두께로 형성할 수 있으며, 유기전계발광소자가 배면발광구조일 경우, 빛을 반사시킬 수 있을 정도로 두껍게 형성할 수 있다.

[0208] 이하, 본 발명의 청색 인광 화합물의 합성예 및 이 화합물의 특성에 관하여 하기 합성예 및 실시예에서 상술하기로 한다. 다만, 하기의 실시예는 본 발명을 예시하는 것일 뿐 본 발명이 하기 실시예에 한정되는 것은 아니다.

[0209] **<u>합성예 1 : 하기 화학식으로 표시되는 화합물 1의 제조</u>**

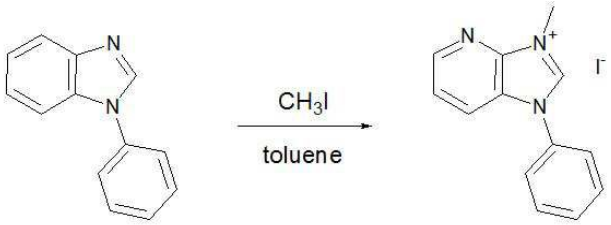
[0210] 

[0211] 1) 리간드 전구체의 합성

[0212] 

A

[0213] 벤즈이미다졸 5.0g(42mmol), 요오드화톨루엔 6.5ml(51mmol)을 요오드화구리(CuI) 0.80g(4.2mmol), 페난트롤린 1.5g(8.4mmol)의 DMF 용액(100ml)에 넣고 세슘카보네이트 28g(84mmol)을 넣어준 후 18시간 환류시킨다. 용액을 실온으로 식히고 실리카겔 패드를 이용하여 거른 후 여액을 감압하여 휘발물을 제거한다. 남은 잔류물을 컬럼크로마토그래피를 통하여 화합물 A 6.9g(78%)을 얻었다.

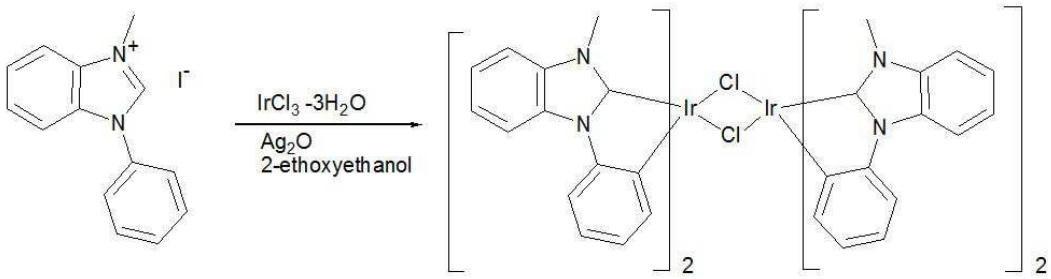
[0214] 

A B

[0215] 이어, 화합물 A 6.0g(29mmol)의 톨루엔(25ml) 용액에 요오드화메탄 2.0ml(32mmol)를 넣고 실온에서 다섯시간 동안 교반 후 용액을 걸러 5.8g의 침전물 B를 얻었다. 여액은 감압조건에서 휘발물을 제거하여 2.5g의 화합물 A를 얻고 여기에 다시 톨루엔 15ml과 요오드화메탄 0.82ml(13mmol)을 넣어 같은 반응을 반복, 3.1g의 B를 추가로 얻

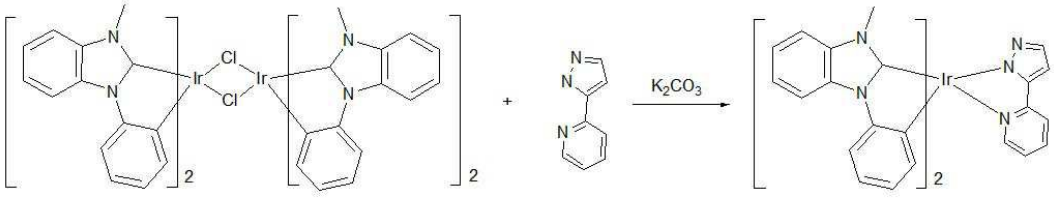
었다(88%). 얻어진 B는 에틸아세테이트로 반복하여 씻고 추가 정제과정 없이 다음 반응에 사용하였다.

[0216] 2) 이리듐 화합물의 합성



[0217] B C

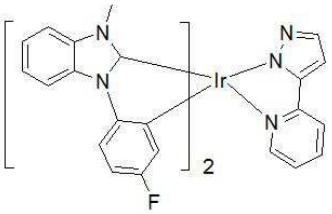
[0218] 질소 분위기 하에서 화합물 B 5.0g(24 mmol), $IrCl_3 \cdot 3H_2O$ 1.78g(6.0mmol), Ag_2O 4.7g(20mmol)을 2-에톡시에탄올 50ml에 넣고 24시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 다이클로로메탄/에탄올로 재침전하여 침전물 C를 얻었다. (16%)



[0219] C D 1

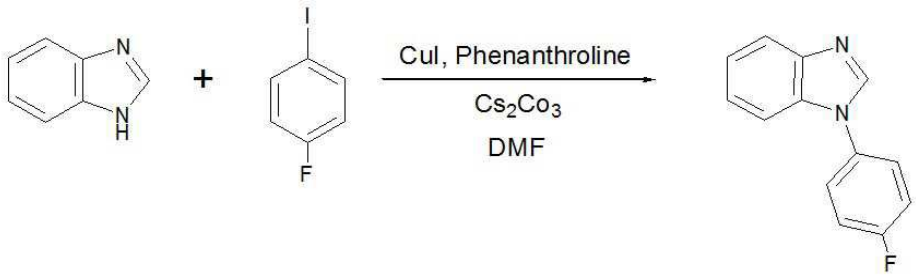
[0220] 질소 분위기 하에서 화합물 C 2.0g(1.6 mmol), D 0.5g(3.4mmol), K_2CO_3 0.47g(3.4mmol)을 2-에톡시에탄올 7ml에 넣고 12시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 컬럼크로마토그래피를 거쳐 화합물 1 0.4g을 얻었다. (32%)

[0221] **<u>합성예 2 : 하기 화학식으로 표시되는 화합물 2의 제조</u>**



[0222]

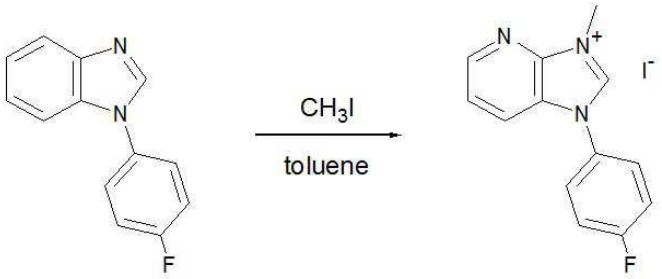
[0223] 1) 리간드 전구체의 합성



[0224] E

[0225] 벤즈이미다졸 5.0g(42mmol), 4-플루오로아이오도벤젠 6.5ml(51mmol)을 요오드화구리(CuI) 0.80g(4.2mmol), 페난트롤린 1.5g(8.4mmol)의 DMF 용액(100ml)에 넣고 세슘카보네이트 28g(84mmol)을 넣어준 후 18시간 환류시킨다. 용액을 실온으로 식히고 실리카겔 패드를 이용하여 거른 후 여액을 감압하여 휘발물을 제거한다. 남은 잔류

물을 컬럼크로마토그래피를 통하여 화합물 A 6.9g(78%)을 얻었다.

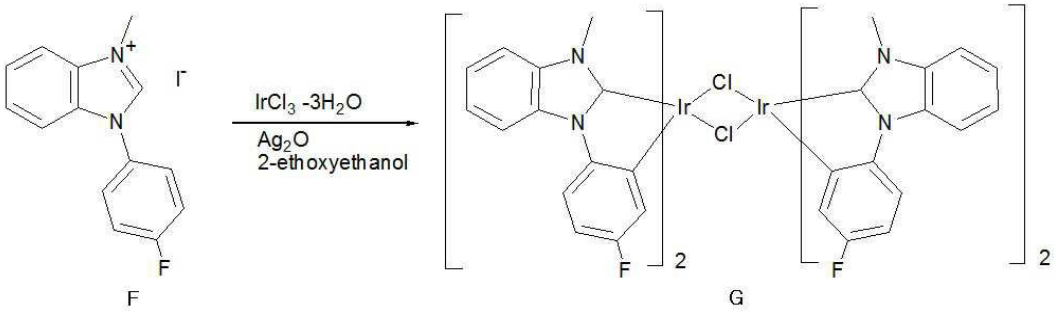


E F

[0226]

[0227] 이어, 화합물 E 6.0g(29mmol)의 톨루엔(25ml) 용액에 요오드화메탄 2.0ml(32mmol)를 넣고 실온에서 다섯시간 동안 교반 후 용액을 걸러 5.8g의 침전물 F를 얻었다. 여액은 감압조건에서 휘발물을 제거하여 2.5g의 화합물 E를 얻고 여기에 다시 톨루엔 15ml과 요오드화메탄 0.82ml(13mmol)을 넣어 같은 반응을 반복, 3.1g의 F를 추가로 얻었다(88%). 얻어진 F는 에틸아세테이트로 반복하여 씻고 추가 정제과정 없이 다음 반응에 사용하였다.

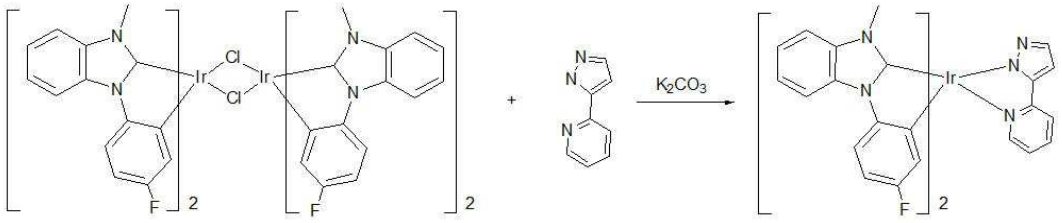
[0228] 2) 이리듐 화합물의 합성



F G

[0229]

[0230] 질소 분위기 하에서 화합물 F 5.0g(24 mmol), $IrCl_3 \cdot 3H_2O$ 1.78g(6.0mmol), Ag_2O 4.7g(20mmol)을 2-에톡시에탄올 50ml에 넣고 24시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 다이클로로메탄/에탄올로 재침전하여 침전물 G를 얻었다. (16%)

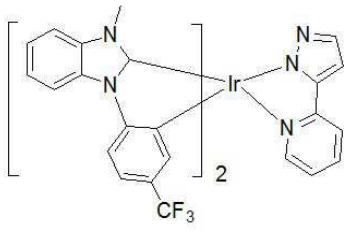


G D 2

[0231]

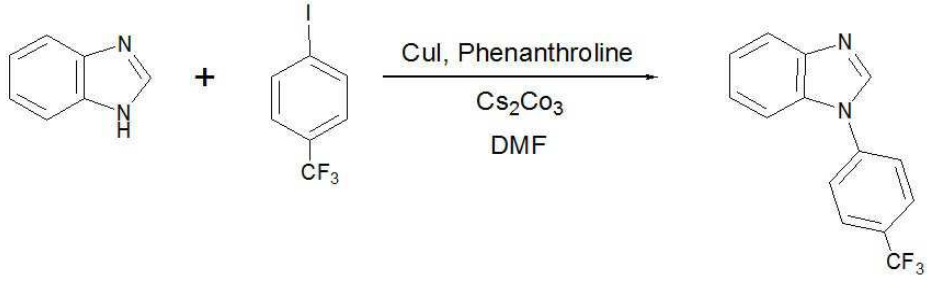
[0232] 질소 분위기 하에서 화합물 G 2.0g(1.6 mmol), D 0.5g(3.4mmol), K_2CO_3 0.47g(3.4mmol)을 2-에톡시에탄올 7ml에 넣고 12시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 컬럼크로마토그래피를 거쳐 화합물 2 0.4g을 얻었다. (32%)

[0233] **<u>합성예 3 : 하기 화학식으로 표시되는 화합물 3의 제조</u>**



[0234]

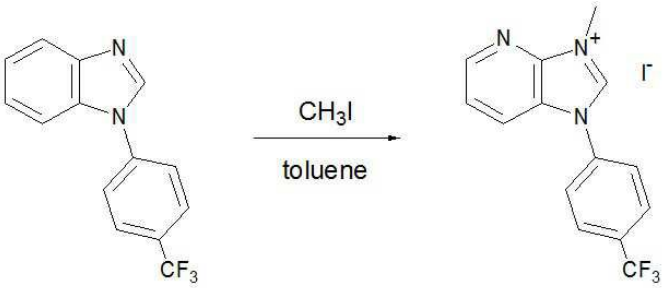
[0235] 1) 리간드 전구체의 합성



H

[0236]

[0237] 벤즈이미다졸 5.0g(42mmol), 4-아이오도벤조트리플루오라이드 6.5ml(51mmol)를 요오드화구리(CuI) 0.80g(4.2mmol), 페난트롤린 1.5g(8.4mmol)의 DMF 용액(100ml)에 넣고 세슘카보네이트 28g(84mmol)을 넣어준 후 18시간 환류시킨다. 용액을 실온으로 식히고 실리카겔 패드를 이용하여 거른 후 여액을 감압하여 휘발물을 제거한다. 남은 잔류물을 컬럼크로마토그래피를 통하여 화합물 H 6.9g(78%)을 얻었다.

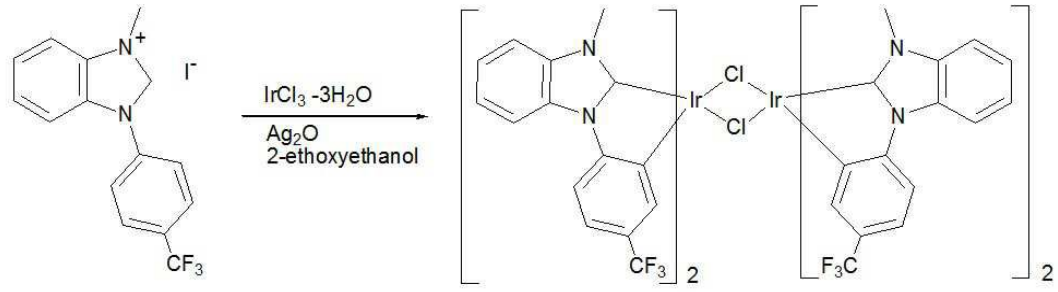


H I

[0238]

[0239] 이어, 화합물 H 6.0g(29mmol)의 톨루엔(25ml) 용액에 요오드화메탄 2.0ml(32mmol)를 넣고 실온에서 다섯시간 동안 교반 후 용액을 걸러 5.8g의 침전물 I를 얻었다. 여액은 감압조건에서 휘발물을 제거하여 2.5g의 화합물 H를 얻고 여기에 다시 톨루엔 15ml과 요오드화메탄 0.82ml(13mmol)을 넣어 같은 반응을 반복, 3.1g의 I를 추가로 얻었다(88%). 얻어진 I는 에틸아세테이트로 반복하여 씻고 추가 정제과정 없이 다음 반응에 사용하였다.

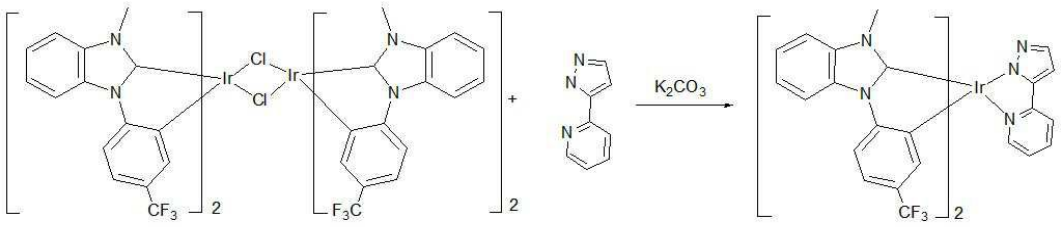
[0240] 2) 이리듐 화합물의 합성



I J

[0241]

[0242] 질소 분위기 하에서 화합물 I 5.0g(24 mmol), $IrCl_3 \cdot 3H_2O$ 1.78g(6.0mmol), Ag_2O 4.7g(20mmol)을 2-에톡시에탄올 50ml에 넣고 24시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 다이클로로메탄/에탄올로 재침전하여 침전물 J를 얻었다. (16%)

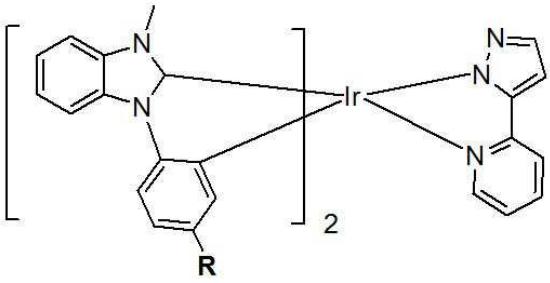


J D 3

[0243]

[0244] 질소 분위기 하에서 화합물 J 2.0g(1.6 mmol), D 0.5g(3.4mmol), K_2CO_3 0.47g(3.4mmol)을 2-에톡시에탄올 7ml에 넣고 12시간 동안 환류하여 교반하였다. 반응이 종료된 후, 침전물을 걸러내고 여과액을 감압조건 하에서 농축하였다. 잔류물은 컬럼크로마토그래피를 거쳐 화합물 3 0.4g을 얻었다. (32%)

[0245] 전술한 합성예들에서 제조된 본 발명의 화합물 1 내지 3의 구조, 최대 발광 파장(λmax)을 하기 표 1에 나타내었다. 그리고, 화합물 1 내지 3의 UV 흡수 스펙트럼과 상온에서의 PL 스펙트럼을 측정하여 도 2 내지 4에 각각 나타내었다.



[0246]

표 1

[0247]

	R	최대발광파장(λmax)
화합물1	H	482
화합물2	F	474
화합물3	CF_3	473

[0248] 상기 표 1 및 도 2 내지 도 4를 참조하면, 본 발명의 청색 인광 이리듐 화합물 1 내지 3은 473nm에서 482nm의 최대 발광 파장을 나타내는 것을 확인할 수 있었다.

[0249] 본 발명의 청색 인광 화합물 및 이를 사용한 유기전계발광소자는 삼중항 에너지가 높은 신규 청색 인광 화합물을 제조하고, 이를 유기전계발광소자의 발광층의 도펀트로 형성함으로써, 발광층에서의 에너지 전이를 용이하게 하여 청색의 발광효율을 향상시킬 수 있는 이점이 있다.

[0250] 이상 첨부된 도면을 참조하여 본 발명의 실시예를 설명하였지만, 상술한 본 발명의 기술적 구성은 본 발명이 속하는 기술 분야의 당업자가 본 발명의 그 기술적 사상이나 필수적 특징을 변경하지 않고서 다른 구체적인 형태로 실시될 수 있다는 것을 이해할 수 있을 것이다. 그러므로 이상에서 기술한 실시 예들은 모든 면에서 예시적인 것이며 한정적인 것이 아닌 것으로서 이해되어야 한다. 아울러, 본 발명의 범위는 상기 상세한 설명보다는 후술하는 특허청구범위에 의하여 나타내어진다. 또한, 특허청구범위의 의미 및 범위 그리고 그 등가 개념으로부터 도출되는 모든 변경 또는 변형된 형태가 본 발명의 범위에 포함되는 것으로 해석되어야 한다.

부호의 설명

[0251] 100 : 유기전계발광소자 110 : 양극

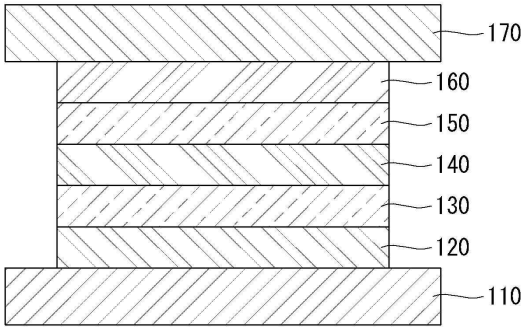
120 : 정공주입층 130 : 정공수송층

140 : 발광층 150 : 전자수송층

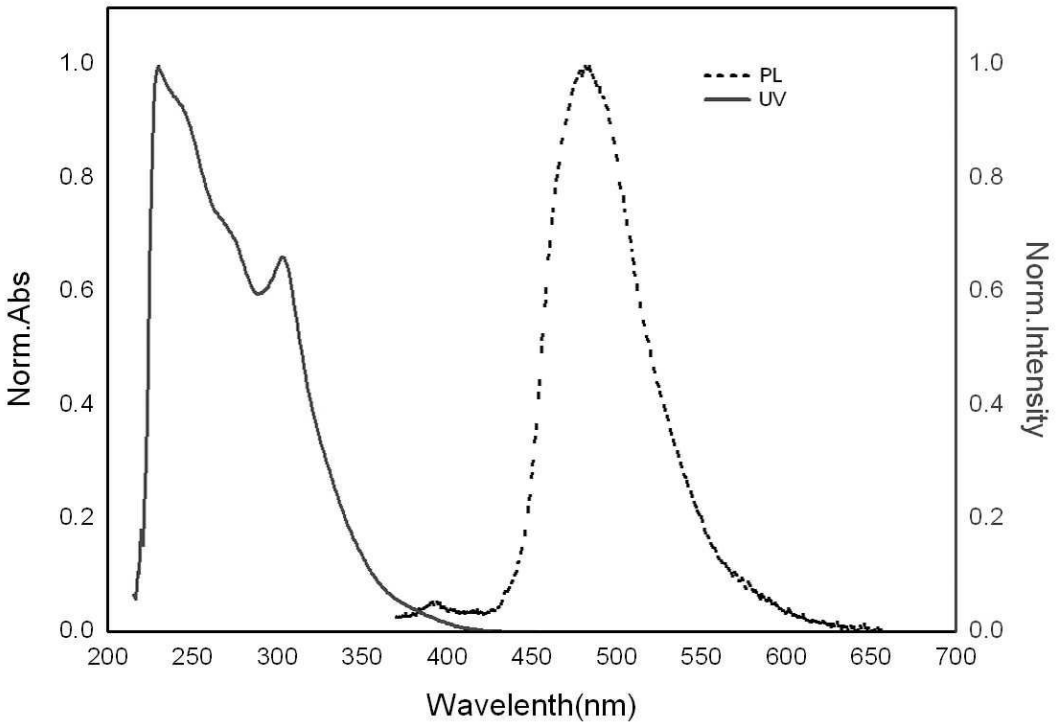
160 : 전자주입층 170 : 음극

도면

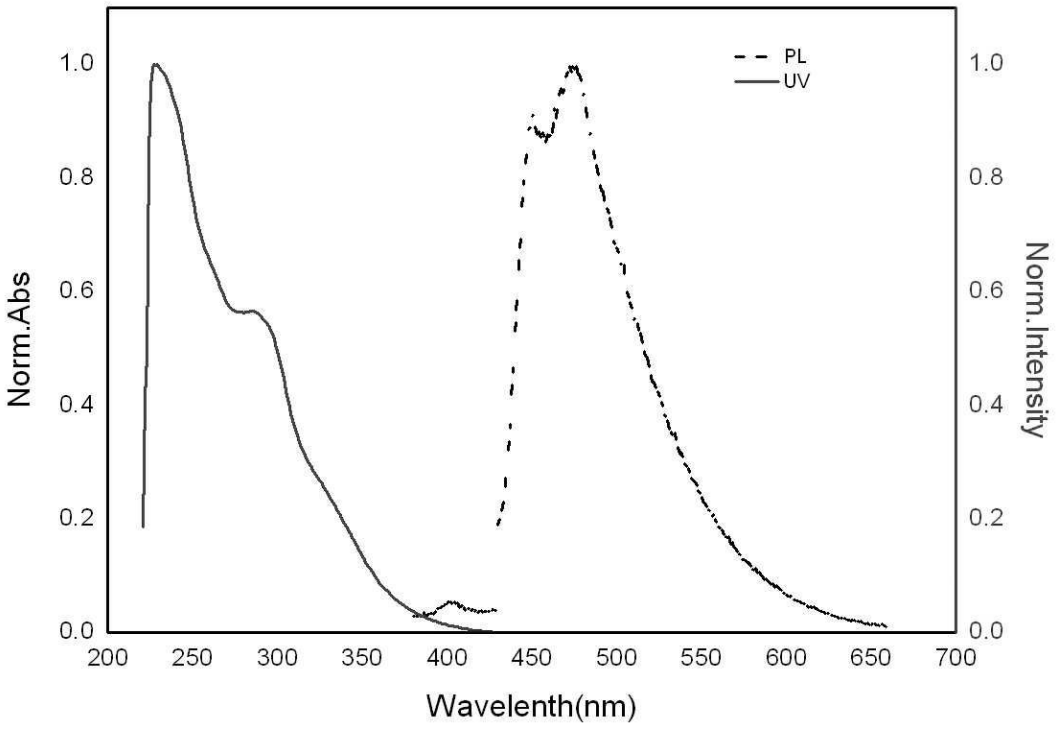
도면1



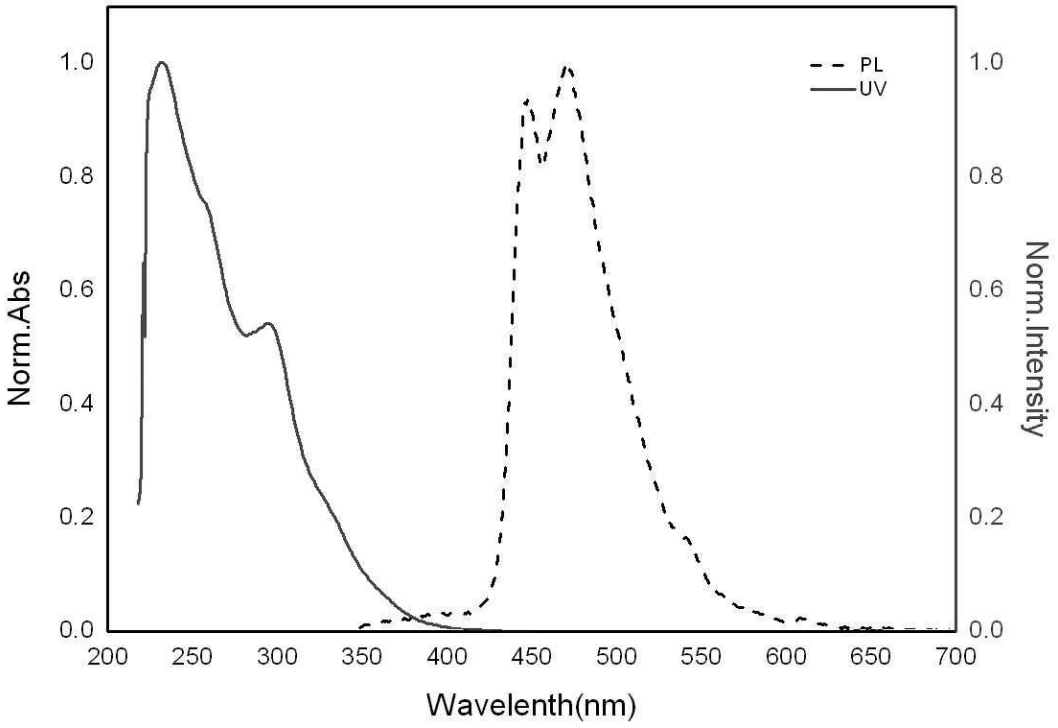
도면2



도면3


PL
UV
Norm.Abs
Norm.Intensity
Wavelenth(nm)
0.0
0.2
0.4
0.6
0.8
1.0
200
250
300
350
400
450
500
550
600
650
700

도면4


PL
UV
Norm.Abs
Norm.Intensity
Wavelenth(nm)
0.0
0.2
0.4
0.6
0.8
1.0
200
250
300
350
400
450
500
550
600
650
700

专利名称(译)	标题：蓝色磷光化合物和使用其的有机电致发光器件		
公开(公告)号	KR1020140079993A	公开(公告)日	2014-06-30
申请号	KR1020120149289	申请日	2012-12-20
[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG显示器有限公司		
当前申请(专利权)人(译)	LG显示器有限公司		
[标]发明人	HEO HYE RYOUNG 허혜령 SHIN IN AE 신인애		
发明人	허혜령 신인애		
IPC分类号	C09K11/06 H01L51/50		
CPC分类号	H01L51/0085 C07F15/0033 C09K2211/185		
外部链接	Espacenet		

摘要(译)

根据本发明实施方案的蓝色磷光化合物由化学式1表示。在化学式1中，R 1至R 15是选自由氢，氘，F，Cl和Br的卤素组成的组中的一种，C1-C20的烷基，C1-C20的烷氧基，C1-C20的环烷基，取代或未取代的芳香族基团C6-C20，C5-C20的取代或未取代的杂环基，氰基，三氟甲基，C1-C20的胺基，被C6-C20的芳香基取代的胺基，被C5-C20的杂环基取代的胺基和C1-C20的甲硅烷基，独立。